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Volume of grain and fertilizer requiring transportation: projections to 1984-1985 and 1989-1990 by counties in Iowa

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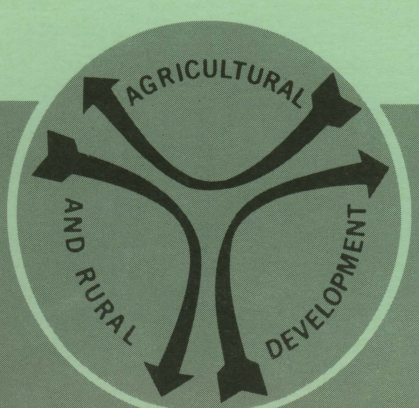

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VOLUME OF GRAIN AND FERTILIZER REQUIRING TRANSPORTATION: PROJECTIONS TO 1984-1985 AND 1989-1990 BY COUNTIES IN IOWA

by

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INTRODUCTION

Iowa's grain and fertilizer transportation and distribution systems are undergoing major changes. Some rail lines are being upgraded; others are being abandoned. Major grain elevator expansions have been completed at some locations, and other grain and fertilizer facility expansions are being considered. Information on both the volume of grain likely to be moved out of Iowa counties and on the required in-shipments of fertilizer in future years is needed to guide decisions on grain and fertilizer transportation and distribution facility expansion, relocation, or abandonment.

This report, which essentially updates a 1975 publication [1], provides such information. Included are estimates of volumes of grain moving out of Iowa counties in recent years along with projections of the quantity of grain to be moved out of Iowa counties in 1984-1985 and in 1989-1990 and the amount of fertilizer to be moved into these counties during those same years.

Other Sources of Grain Sales

The Iowa Crop and Livestock Reporting Service prepares annual estimates of the quantities of grain sold off farms where the grain is produced. However, these estimates include both farm-to-farm and farm-to-elevator-to-farm sales and therefore do not accurately reflect the amount of grain moving beyond country elevators. Information on

the quantities of grain moving into commercial channels is available for counties in the U.S. Census of Agriculture but only once every five years. Thus, this revised report provides a unique source of information on volumes of grain and fertilizer requiring transportation services to and from Iowa counties. This information is essential for investment planning by grain and fertilizer marketing firms and the transportation industry. It represents a potentially useful input in planning efficient handling and transportation systems to maintain Iowa's competitive position in national and international markets.

Method of Presentation

The first section of the report presents estimates of the volume of corn, soybeans, and oats that moved out of Iowa counties in 1960 and 1975 as well as projected quantities of these grains to be shipped from Iowa counties in 1985 and 1990.

The second section deals with fertilizer usage. This section presents projections of the amounts and types of fertilizer to be applied in 1984 and 1989. Fertilizer consumption in the years ahead will depend on a number of factors such as environmental restrictions, available supplies, fertilizer and crop prices, and acreages of row crops. Possible changes in the mix of anhydrous and non-anhydrous fertilizers also will have a major bearing on fertilizer transportation needs. For example, Iowa's anhydrous ammonia supply is now

transportated into the state largely by pipeline. If increases in demand for nitrogen nutrients are satisfied by increases in urea or other solid forms of dry nitrogen fertilizer rather than anhydrous ammonia, more rail, truck and (or) barge movement would be needed. In addition, the required tonnage of fertilizer materials would be increased, since other types of fertilizer have a much lower nitrogen nutrient content per pound than anhydrous ammonia. The potential impact of these factors needs to be considered to accurately evaluate fertilizer transportation needs in future years.

COMMERCIAL GRAIN SALES, 1960 AND 1975

Commercial grain sales for 1960 and 1975 are defined here as the residual after subtracting estimated on-farm usage of corn, oats, and soybeans from the reported county production. The difference between reported production and estimated usage on farms is assumed to be sold through commercial channels.

Grain and Livestock Estimates

Estimates of corn, soybean, and oat production by counties were taken directly from the Iowa Annual Farm Census [7] for the years 1959-1972, and from the Iowa Agricultural Statistics [6] for the years 1973-1976. The basic source of data on livestock numbers by county other than hogs marketed also was from the Iowa Annual Farm Census for the years 1960-1972 and the Iowa Agricultural Statistics for the years 1973-1976. However, the Iowa Agricultural Statistics does not contain county data for turkeys and broilers. Therefore, data from the Iowa Annual Farm Census for these two livestock categories also were used for the years 1973-1976. County livestock data from the Iowa Annual Farm Census are based on tax assessor reports and historically have shown lower levels of production for many classes of livestock than have been indicated by marketing levels and other published reports of state-wide production. To allow for such biases, county livestock data from the Iowa Annual Farm Census were adjusted to reflect state

production and marketing levels estimated by the Statistical Reporting Service of the U.S. Department of Agriculture. The adjustment procedure for each class of livestock except hogs marketed was to divide the county estimate by a ratio of the state totals from the census and the corresponding state totals from the Statistical Reporting Service of the USDA. In other words, it was assumed that biases in the census data were uniform from one county to another.

County pig crop data were available directly from the Statistical Reporting Service for the years 1960-1972 and from the Iowa Agricultural Statistics for the years 1973-1976. The Statistical Reporting Service data were believed to be more accurate than census estimates and were used in estimating hogs marketed by counties. Hogs marketed were defined as the county pig crop minus the estimated death losses plus estimated shipments into the county. It was assumed that the state average death rate was constant in all counties and that in-shipments of pigs were distributed proportionately to size of county pig crop in all counties. The equation used to estimate the number of hogs marketed is in Table 1, Appendix C.

Feed Requirement Estimates

Estimated feed requirements per animal expressed in bushels of corn or corn equivalent are presented in Table 1. Feeding rates were developed through discussions with Iowa State University staff members in Dairy, Poultry, and Animal Science Departments and from

published and unpublished reports on feeding requirements [2, 9]. Total feeding requirements for each county were estimated by multiplying the number of head of livestock by the estimated feeding rates per head.[1]

Allowances for breeding stock needs are included in all classes except grain-fed cattle marketed. Beef cows are included as a separate class because approximately half the grain-fed cattle marketed in Iowa come from cow herds outside the state.

Grain requirements for milk cows were based on a feeding program that included an annual consumption of five tons of corn silage per cow. County silage production was allocated first to dairy cows, and any residual above five tons per cow was assumed to be allocated to grain-fed cattle. The corn-consumption rate for grain-fed cattle listed in Table 1 is based on rations containing no silage. The amount of silage available for cattle feeding varies significantly from county to county.

The 1973-1975 average amount of silage used for grain-fed cattle by county was used as the average silage feeding rate per head and was assumed to remain constant through 1990. These volumes of silage were substituted for corn in cattle feeding at a rate of one ton of silage

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[1] Throughout this report, "corn" refers to corn for grain only; silage production and feeding are specified separately.

Table 1. Estimated average bushels of corn consumed annually per animal by class of livestock and poultry 1960 to 1975

Class of Livestock	Annual Feeding Rate in Bushels per Head
Milk Cows	71.4[a/]
Beef Cows	5.0
Hogs Marketed	14.7
Grain-Fed Cattle Marketed	55.2
Sheep and Lambs Marketed	4.5
Hens and Pullets	1.2
Turkeys	0.9
Broilers	0.1

[a/] Assumes each cow consumes 5 tons of silage in addition to the 71.4 bushels of corn.

for 6.5 bushels of corn. Consumption of silage per head in dairy operations also was assumed to remain at present levels.

County Grain Sales

Estimated corn sales for a given county were based on production from the previous crop year (t-1) and the current year's (t) livestock numbers, because it is largely the previous year's grain that will be consumed and (or) sold in the current year.

Corn sales are defined as corn production in county i, year t-1, minus the number of head of each type of livestock in year t, times the

corn feeding rate for that type of livestock.[2] The estimated amount of corn fed was reduced by substituting the oats fed for corn at the rate of two bushels of oats for one bushel of corn. The equation used to estimate commercial corn sales is in Table 2, Appendix C.

Oat sales were estimated by multiplying production times the percentage of oats sold off farms as reported in the 1964 U.S. Census of Agriculture, adjusted for the increase in oat sales over the years.[3] It was assumed that each county's oat sales increased at the same rate as for the entire state. The residual oats were assumed to have been fed to livestock on farms.[4] The equation for estimating commercial oat sales is in Table 3, Appendix C.

Because only a small amount of soybeans is normally used on farms, a slightly different procedure was used to estimate soybean sales. Soybean sales were defined as county soybean production minus one bushel

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[2]There may be a small error in this procedure because of using calendar year data rather than marketing year data, but it is believed to be of limited significance in planning grain transportation facilities. Lack of livestock data by crop marketing year prevented more precise calculations.

[3]1964 was the last year county oat sales were reported. State oat sales are reported in Field and Seed Crops -- Production Farm Use Sales Values by State [5].

[4]The estimate of commercial oat sales is biased upward slightly, because it includes farm-to-farm sales and farm-to-elevator-to-farm sales. However, because of the low levels of oat production, it is believed that this procedure introduces only a small error in the estimates.

of soybean seed per acre. The equation for estimating county sales of soybeans is found in Table 4, Appendix C.

PROJECTIONS OF GRAIN SALES TO 1985 AND 1990

The basic procedure for projecting commercial grain sales to 1985 and 1990 involved four steps. Step one was to project corn, oat, and soybean production to 1984 and 1989 and livestock numbers to 1985 and 1990 for the state. The second step was to project county percentage shares of state grain and livestock production by a non-linear regression of historical county shares. Projected county grain and livestock production was then derived by multiplying the projected state production total by the county percentage share of total production. The third step was to project county livestock feeding requirements in 1985 and 1990. The final step was to subtract projected grain feeding requirements and soybean seed requirements from projected production levels to obtain estimates of grain to be moved through commercial channels.

Projected Iowa Grain and Livestock Production

The method used to project Iowa grain production to 1984 and 1989 and livestock production to 1985 and 1990 was to project Iowa's share of the estimated national grain and livestock production in 1984, 1985, 1989 and 1990. The national grain and livestock production estimates

were obtained from working materials developed by the Economics Projections Program, Economics, Statistics and Cooperatives Service, United States Department of Agriculture. The projected Iowa percentage share of national production to 1984-1985 and 1989-1990 was developed on the basis of past trends in Iowa's share of U.S. production.

National Demand Projections

The national grain and livestock projections were based on an analysis of national demand for farm production and projected demand in 1985 and 1990. Important assumptions behind these projections include a total U.S. population of 253.7 million people by 1990 and an average growth in real gross national product of about 3.5 percent per year. A high level of agricultural trade is assumed with continued increases in exports to the USSR and both Eastern and Western European countries. On the supply side, the rate of growth in public expenditures for agricultural research and extension is assumed to be 7 percent per year. Climate is assumed to be favorable with normal to above normal rainfall and crop yields

Iowa Shares of U.S. Production

Iowa's shares of national grain production were projected to 1984 and 1989 by use of a non-linear regression of 1960-1975 shares. Drought in Iowa in 1976 and 1977 substantially reduced crop production compared

to other states. Therefore, data on Iowa's share of national crop production in these years were excluded from the regression analysis. It was felt that the inclusion of these data would lead to unjustifiable downward bias in the projections for 1984 and 1989, given the cyclical nature of weather patterns. The equations for estimating and projecting Iowa's shares are in Table 5, Appendix C.

Table 2 shows Iowa's shares of U.S. production and projections of grain output for the United States and Iowa for 1984 and 1989. The Iowa share of U.S. corn production is projected to remain at approximately the same level as experienced from 1960 to 1975. The Iowa share of U.S. soybean production is projected to increase but at a slower rate than from 1960 to 1975. The share of U.S. oat production is projected to continue to decline but at a slower rate of decrease than from 1960 to 1975.

The USDA national livestock projections were expressed in units of production, such as carcass weight of beef or pork and million hundredweights of milk. Therefore, Iowa's shares of national livestock production were projected to 1985 and 1990 by use of a non-linear regression (Equation B, Table 5, Appendix C) of 1960-1977 shares using the same production units, except for beef, pork, and lamb and mutton production. Historical data for Iowa cattle and calves, hogs and pigs, and sheep and lamb marketings in terms of carcass weight were not available. Therefore, Iowa's projected shares of carcass weight of

Table 2. U.S. and Iowa production of corn, soybeans and oats 1960, 1970, and 1975, and projections to 1984 and 1989

	Type of Grain		
	Corn	Soybeans	Oats
U.S. Production	(Million bushels)		
1960	3,907	555	1,153
1970	4,152	1,127	915
1975	5,829	1,547	642
1978 preliminary	6,890	1,810	601
1984	6,759	2,057	717
1989	7,305	2,285	786
Iowa's Share of U.S. Production	(Percentage)		
1960	19.77	11.94	14.90
1970	20.87	16.38	10.28
1975	19.18	15.31	11.76
1978 preliminary	20.55	15.33	11.09
1984	20.81	17.28	10.18
1989	20.83	17.56	9.96
Iowa Production	(Million bushels)		
1960	773	66	172
1970	867	185	94
1975	1,118	237	76
1978 preliminary	1,416	278	67
1984	1,407	356	73
1989	1,521	401	78

cattle and calves, hogs and pigs, and sheep and lambs were based upon Iowa's historical shares of liveweight marketings. The resulting state livestock projections were then converted into projections of animal numbers. Following is an outline of the procedure used to arrive at estimates of animal numbers:

Fed cattle marketed

The weighted 1972-1976 U.S. average carcass weight of cattle slaughtered was 609 pounds per head. Because of a lack of historical data, Iowa's average carcass weight of cattle slaughtered was assumed

to be the same as the U.S. average carcass weight.[5] Iowa's projected number of cattle slaughtered was estimated by dividing the projected Iowa beef production by the average carcass weight per head. The 1972-1976 average ratio of Iowa fed cattle marketings to total Iowa cattle slaughtered was 0.72. Therefore, to convert the number of cattle slaughtered into numbers of fed cattle marketed, we assumed that 72 percent of the cattle slaughtered would come from cattle fed in Iowa.

Dairy cow numbers

Based upon a non-linear regression (Equation A, Table 6, Appendix C) of 1960-1977 Iowa milk output per cow, milk production per cow was projected at 11,419 pounds in 1985 and 12,043 pounds in 1990. This would be a moderate increase from recent levels but would represent a gradual slowing in the growth rate in output per cow. Dairy cow numbers were projected by dividing milk production by projected milk output per cow for each year.

Beef cows

Based upon the 1971-1975 average ratio of Iowa beef cow numbers and red cattle marketings, fed cattle marketings were multiplied by 0.5818 to obtain the estimated beef cow numbers. In effect, this procedure assumes that the proportion of grain-fed cattle coming from out-of-state sources in 1985 and 1990 will remain the same as the average proportion in 1971-1975.

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[5]Because Iowa's historic average liveweight of cattle slaughtered is slightly higher than the U.S. average, this assumption may lead to an upward bias in the projected number of Iowa cattle slaughtered. However, it is believed that this assumption introduces only a small error in the projections.

Hogs marketed

The 1971-1975 average carcass weight was 182.3 pounds per hog marketed. Projected pork production in carcass weight was divided by this average carcass weight per head to estimate the number of hogs marketed.

Laying flock numbers

Based upon a non-linear regression (Equation B, Table 6, Appendix C) of the 1960-1977 Iowa egg production per bird, the average laying rate was projected to be 233 eggs per bird in 1985 and 234 eggs per bird in 1990. Projected egg production was divided by the average laying rate per bird to obtain the projected number of layers.

Sheep and lambs

Average carcass weights per head were assumed to remain at present levels, 53 pounds per head. Thus, the USDA projected percentage decrease of sheep and lamb production by carcass weight was applied to Iowa's 1974-1976 average sheep and lamb numbers to project sheep and lamb numbers.

Turkeys

Based upon the trend in demand for heavier turkeys for further processing, average slaughter weights were assumed to increase slightly from the current average slaughter weight of 20 pounds per bird to 21 pounds per bird in 1985 and 22 pounds per bird in 1990. Projected turkey production was divided by the projected average slaughter weight per bird to obtain the projected number of turkeys.

Broilers

Average slaughter weights were assumed to remain at present levels. Therefore, projected broiler production was divided by the average slaughter weight per bird to obtain the projected number of broilers.

Table 3 shows the estimated Iowa livestock production in 1960, 1970, and 1975, and projections for 1985 and 1990.

Table 3. Production of livestock and poultry in 1960, 1970, and 1975, and projections to 1985 and 1990 in million head, Iowa

	1960	1970	1975	1985	1990
Fed cattle marketed	2.6	4.6	2.6	3.0	3.3
Hogs marketed	18.2	22.5	16.0	21.3	23.1
Beef cows	1.0	1.4	1.9	1.8	1.9
Dairy cows	0.9	0.6	0.4	0.4	0.4
Sheep and lambs	1.6	0.7	0.4	0.3	0.3
Hens and pullets	24.6	13.2	8.6	8.2	7.9
Turkeys	7.7	5.5	6.3	5.6	5.9
Broilers	4.0	2.7	3.2	3.3	3.8

Projected County Grain Production

After state projections to 1984 and 1989 were developed using the procedure outlined above, the next step was to allocate production among counties. This was done by multiplying projected Iowa production by each county's projected share of the state total.

Projected county shares

Projected county shares of state grain production were derived first by computing the counties' shares for 1960-1975. This was done by dividing the county production by Iowa's total production for each year from 1960-1975. The county shares were then projected by a non-linear regression to 1984 and 1989. The projected county grain production was derived

by multiplying Iowa's projected production by the projected county share for each grain for 1984 and 1989. The equations for estimating and projecting the county shares of grain are found in Table 7, Appendix C.

Yield estimates

Potential grain yields for each county based on present technology and management practices were derived from published and unpublished materials developed by Iowa State University agronomists [3, 10]. These data were used as a base for projecting grain yields to 1984 and 1989. The base yields are believed attainable as a five-year average with present technology and average weather conditions. Potential county yields are based on soil types, slope and erosion factors, conservation methods, and weather factors. Yields obtained in any one year may vary considerably from projected yields at any or all locations due to the variability of these factors. Corn yields in 1984 and 1989 were projected by raising the base yields 17 and 24 percent, respectively.

Soybean and oat yields were assumed to vary proportionately with corn. Based on results from yield test plots and present corn-soybean yield relationships, soybean yields were established at 35 percent of the estimated corn yields. Oat yields are more difficult to estimate because weather and diseases influence oat yields differently than corn or soybean yields on the same soils. Taking into account weather influences, oat yields in northwest Iowa were established at 85 percent of corn yields, compared with 75 percent in north central and northeast Iowa, 70 percent in west central, central, and east central Iowa, 50

percent in southwestern Iowa and 55 percent in south central and southeastern Iowa [3].

Acreage requirements and conservation practices

Maximum conservation practices were assumed in projecting the amount of land available in each county for row crops in 1984 and 1989.[6] These conservation practices were assumed to make available for row crop use 100 percent of A slope, 100 percent of B slope, 90 percent of C slope, and 80 percent of D slope land.[7] Projected row crop acres were considered an absolute constraint in the allocation of state corn and soybean production to individual counties.

Row crop acreage is defined as land used for corn, corn silage, and soybeans. Therefore, projections of corn silage acreage also were needed to establish the row crop acreage. Silage production was projected by dividing projected corn yields by 6.5 bushels of corn equivalent per ton of silage to abtain silage yields in tons per acre. Next, corn silage production was projected by multiplying the projected county numbers of milk cows times five tons per head plus the projected numbers of grain-fed cattle times the 1973-1975 silage feeding rates per head of grain-fed cattle. Since it was assumed that all silage is consumed in the county where produced, this sum was the projected silage production in

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[6]Available row crop acreages and cropland acreages were obtained from Iowa Conservation Needs Inventory [8]. Slopes for A, B, C, and D land are A = 0-2 percent, B = 2-5 percent, C = 509 percent, D = 9-14 percent.

[7]Maximum conservation level would require extensive use of terracing, conservation tillage, and other erosion control practices on the C and D slope land.

the county. The final step was to determine silage acres required by dividing silage production by the projected silage yield in tons per acre. Equations for these three steps are in Table 8, Appendix C.

Corn, corn silage, and soybean acreage were allocated to counties by soil slopes. First, all A slope land was used for these crops, followed by B slope, C slope, and finally the available D slope land. The level of conservation practices affected this procedure by limiting the amount of land available in C and D slope land. Corn, corn silage, and soybean acres were allocated to each slope according to the projected ratios of individual crop acres to the total row crop acres needed. For example, if the production projections for a county called for 5,000 acres of corn, 1,000 acres of silage, and 4,000 acres of soybeans, then 50 percent of A slope land would be allocated to corn, 10 percent to silage, and 40 percent to soybeans. These same ratios will apply to B, C, and D slopes for that county. In cases where acreage available for row crops exceeded projected plantings, the unused land was assigned to higher slope soils.

Oats were allocated to the land remaining after the row crop acres were determined. If the projected production of row crops used all the land available for row crop, oat production would be allocated to the remaining C and D slope land. Under the maximum level of conservation practices, 10 percent of C slope and 20 percent of D slope land would be available for oat production.

Upper bound on county production

The possibility that the land required to meet grain production forecasts for a particular county might exceed the row crop acreage

available created the need for an upper bound on grain production estimates. An upper bound was imposed on corn and soybean production whenever total row crop acres available were less than acreage requirements needed to satisfy the demand projections. Likewise, an upper bound was imposed on oat production whenever total cropland (A, B, C, and D slopes) was less than the acreage requirement. In counties where the upper bounds were reached, additional production needs were reallocated to other counties. Because of rotation requirements and potential disease problems for continuous soybeans, county soybean acreages were restricted to a maximum of the corn plus silage acreages.

If more acreage was needed to meet grain demand projections than was available in a given county, the additional grain needs were reallocated to counties with excess row crop acres. Silage acreage was not altered, because it is considered a function of livestock numbers. Equations for the reallocation procedure are in Table 9, Appendix C.

Projected County Livestock Production

After state projections of 1985 and 1990 livestock production were developed using the derived demand procedure, the next step was to allocate production among the counties. This was done by multiplying projected Iowa production by each county's projected share of the state total. Equations used in this process are presented in Table 7, Appendix C.

County shares of state production were projected based on a non-linear regression of 1960-1975 shares for all classes of livestock. The resulting livestock projections were used in determining the amount of corn consumed within the county and in projecting commercial grain sales.

Feeding Requirements

Livestock feeding requirements per head for 1985 and 1990 were modified from the 1975 rates as shown in Table 4. A slight decrease in roughage was projected for milk cows. However, a slight increase in roughage was projected for beef cows. Based on expected adjustments in grading and feeding methods, a decrease in the feeding requirements of grain-fed cattle was projected. Grain-fed cattle feeding requirements were adjusted according to the average amount of silage fed in the county, using the same procedure developed for 1960-1975 estimates. Feeding requirements for turkeys were increased slightly to correspond with projected increases in slaughter weights.

Projected County Grain Sales

The final step in calculating county grain sales was to use the methods previously described and the equations found in Tables 2, 3, and 4 of Appendix C, along with the modified corn feeding rates and projected livestock numbers. Grain production and sales results are presented in Appendix A. Livestock numbers are presented in Appendix B.

Table 4. Projected bushels of corn consumed annually per animal by class of livestock, 1985 and 1990

Class of livestock	Annual feeding rate in bushels per head	
	1985	1990
Milk cows	74.5[a]	74.5[a]
Beef cows	4.0	4.0
Hogs marketed	14.7	14.7
Grain-fed cattle marketed	46.9	45.6
Sheep and lambs marketed	4.5	4.5
Hens and pullets	1.2	1.2
Turkeys	0.95	1.0
Broilers	0.1	0.1

a Assumes each cow consumes 5 tons of silage in addition to the 74.5 bushels of corn.

PROJECTED FERTILIZER USAGE TO 1984 AND 1989

The procedure to project the quantity of fertilizer materials to be transported into Iowa counties for the 1984 and 1989 fertilizer seasons involved two steps. First, fertilizer consumption in terms of primary nutrients -- nitrogen, phosphorus, and potassium -- was projected by multiplying projected crop acres by the projected fertilizer application rates per acre.[8] Projected application rates were based on 1970-71 levels adjusted upward to reflect increased productivity growth in crop yields. Second, the projected 1984 and 1989

[8] Hereinafter, the basic plant nutrients are expressed as N, P_2O_5, and K_2O.

total fertilizer nutrient consumption data were converted into tons of total fertilizer materials by projecting each material's percentage share of total nutrient consumption.

Application Rates Per Acre

Fertilizer sales for individual counties in 1970 and 1971 were available from a previous study in the form of nutrients sold [1]. Since it is believed that recent fertilizer application rates are only slightly different than the 1970-1971 levels, these application rates by counties were averaged and used as the base application rates. County fertilizer data were reported on a fiscal year basis -- July to June. Thus, July 1970 to June 1971 represents the fertilizer application season for 1971 grain production.

Fertilizer application rates and tonnages of material were separated into N, P_2O_5, and K_2O for each county.[9] This method provides a projection of the amount of actual plant nutrients applied, but it does not specify the form of fertilizer or the total tonnage of fertilizer materials. In projecting the application rates, it was assumed that all the N is assigned to corn acres but the P_2O_5 and K_2O are applied to both corn and soybean acres. Thus, nitrogen application rates were

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[9] See [4].

computed by dividing nitrogen usage by all corn acres, while P_2O_5 and K_2O application rates were computed using all row crop acres.

Since the application rates were based on sales data reported by licensed dealers located within individual counties, some inconsistency among counties occurred because of dealer sales to farmers located in other counties. The following adjustments were made to eliminate this county-to-county sales bias: If county application rates varied more than 10 percent from the Soil Conservation District average, the excess or deficit was assumed to be caused by county-to-county sales. An effort was then made to match up high and low counties. If towns were located on the border of these matched counties, the adjoining high and low counties were combined to obtain an average application rate for each of the combined counties. If no town was located along the border, it was assumed that the high application rate was correct and there were no sales by dealers to farmers outside of the county. In this case, 1970-1971 application rates were left unadjusted.

Fertilizer sales were the only data in this study that required this "border town" adjustment. The need for the adjustment stems from the fact that the fertilizer utilization data were obtained from dealers rather than producers. An individual dealer in some cases may sell fertilizer in more than one county. In the case of grain and livestock, however, the official county data are based on producer surveys and reflect production at the point where the farming operation is carried out.

Nitrogen application rates on corn acres for 1970-1971 were then projected to 1984 and 1989 by increasing them 17 and 24 percent, respectively, corresponding with the projected increases in corn yields. The base application rates for K_2O and P_2O_5 are believed to have approached optimum levels. Therefore, the base P_2O_5 and K_2O application rates were projected to 1984 and 1989 by increasing them by the recommended maintenance levels required to replace the nutrients removed by the increased yields for corn, soybeans, and oats.[10]

In recent years there has been an increasing amount of hay and pasture acres receiving fertilizer. To reflect this demand component, fertilizer applications rates were projected to 1984 and 1989 for hay and pasture acres based upon the removal of N, P_2O_5, and K_2O by these crops.[11] The hay and pasture rates per acre were projected at the state level and were assumed to apply uniformly to all counties.

Projected Fertilizer Nutrient Consumption

Projected 1984 and 1989 plant nutrient requirements were obtained by multiplying the projected application rates per acre by the appropriate 1984 and 1989 projected crop acreages. Nitrogen application rates were multiplied by projected corn acres to estimate nitrogen

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[10] Based on consultation with R. D. Voss, Extension agronomist, Department of Agronomy, Iowa State University, Ames.

[11] Ibid.

consumption on corn. Projected P_2O_5 and K_2O application rates were multiplied by projected row crop acres to project P_2O_5 and K_2O requirements for row crops. Additional N, P_2O_5, and K_2O requirements for the hay and pasture acres receiving fertilizer were estimated by multiplying the projected hay and pasture application rates by the projected hay and pasture acres receiving fertilizer in each county.

Projected Fertilizer Materials

Projected 1984 and 1989 fertilizer materials were obtained by multiplying the projected total nutrient consumption in each county by the projected state percentage share of total nutrient consumption for each material and dividing by the nutrient content of the materials. In other words, it was assumed that each material's percentage share of total nutrient consumption was uniform from one county to another.

Table 5 shows the percentage contribution of direct application materials and mixed grades to total nutrients sold in Iowa by type of primary nutrient for the years 1972-1978 and projections to 1984 and 1989. Mixed grades represent a declining share of total sales for all three primary nutrients. Because of this trend and increased bulk blending at retailers, it is assumed that future volumes of ingredients used in mixed grades will be included either in diammonium phosphate, urea, or muriate of potash. All K_2O nutrient requirements were assumed to be filled by muriate of potash with a nutrient content of 0-0-60.

Table 5. Percentage contribution of direct application fertilizer materials and mixed grades to total nutrients sold by type of primary nutrients 1972-1978, and projections to 1984 and 1989, Iowa

	Nitrogen						Phosphate			Potassium	
Year	Anhydrous Ammonia	Nitrogen Solutions	Urea	Ammonium Nitrate	Diammonium Phosphate	Mixed Grades and Other Materials	Diammonium Phosphate	Triple Superphosphate	Mixed Grades and Other Materials	Muriate of Potash	Mixed Grades and Other Materials
1972	60.0	10.0	3.8	8.7	5.9	11.6	24.7	28.4	46.9	66.2	33.8
1973	52.9	11.5	5.8	9.1	7.6	13.1	32.7	25.2	42.1	68.0	32.0
1974	60.7	8.4	4.6	7.0	8.0	11.3	38.9	23.0	38.1	74.2	25.8
1975	55.7	12.1	6.3	5.8	8.5	11.6	38.1	24.8	37.1	72.6	27.4
1976	57.8	13.4	8.5	5.4	8.6	6.3	49.3	19.6	31.1	77.0	23.0
1977	56.6	13.3	9.2	3.1	10.1	7.7	52.5	15.5	32.0	76.6	23.4
1978	58.2	14.1	8.7	2.6	10.3	6.1	57.3	14.8	27.9	78.5	21.5
1984	49.0	13.1	10.0	0.0	27.9	a	100.0	0.0	a	100.0	a
1989	46.8	14.0	11.2	0.0	28.0	a	100.0	0.0	a	100.0	a

[a] Ingredients of mixed grades are included in diammonium phosphate, urea, and muriate of potash.

All P_2O_5 nutrient requirements were assumed to be satisfied by diammonium phosphate with a nutrient content of 18-46-0. Nitrogen contained in the application of diammonium phosphate on soybean acres was assigned to corn.

With these trends, an increasing share of nitrogen requirements is projected to be met by diammonium phosphate. The percentage share of nitrogen requirements filled by anhydrous ammonia is projected to decline slightly in future years. Shares of other plant nutrients supplied by diammonium phosphate and muriate of potash are projected to increase.

Nitrogen nutrient requirements were projected to be filled entirely by diammonium phosphate, anhydrous ammonia, urea, and nitrogen solutions. Net nitrogen nutrient requirements for each county were obtained by subtracting the nitrogen contribution of the diammonium phosphate from the total nitrogen nutrient requirement. This net nitrogen nutrient requirement was assumed to be satisfied by anhydrous ammonia, urea, and nitrogen solutions in proportion to the projected percentage shares presented in Table 6.

The projected percentage shares in Table 6 were obtained by first computing each material's share of the total nitrogen contribution for 1972-1977. Then the material shares were projected to 1984 and 1989 by a non-linear regression (Table 10, Appendix C). Multiplying the net nitrogen nutrient requirement by the projected material shares and

Table 6. Projected percentage shares of net nitrogen nutrient requirements to 1984 and 1989 by type of material, Iowa

	1984	1989
Anhydrous ammonia	67.89	64.98
Urea	13.91	15.52
Nitrogen solutions	18.20	19.20
	100.00	100.00

then dividing by the nutrient content of each material yields the projected tonnage of each material. Tables 13 and 14 in Appendix A show the projected tons of materials required in each county for 1984 and 1989.

SUMMARY AND RESULTS

Table 7 summarizes the projected changes in grain production, sales, and livestock numbers to 1984-1985 and 1989-1990.

Grain Production

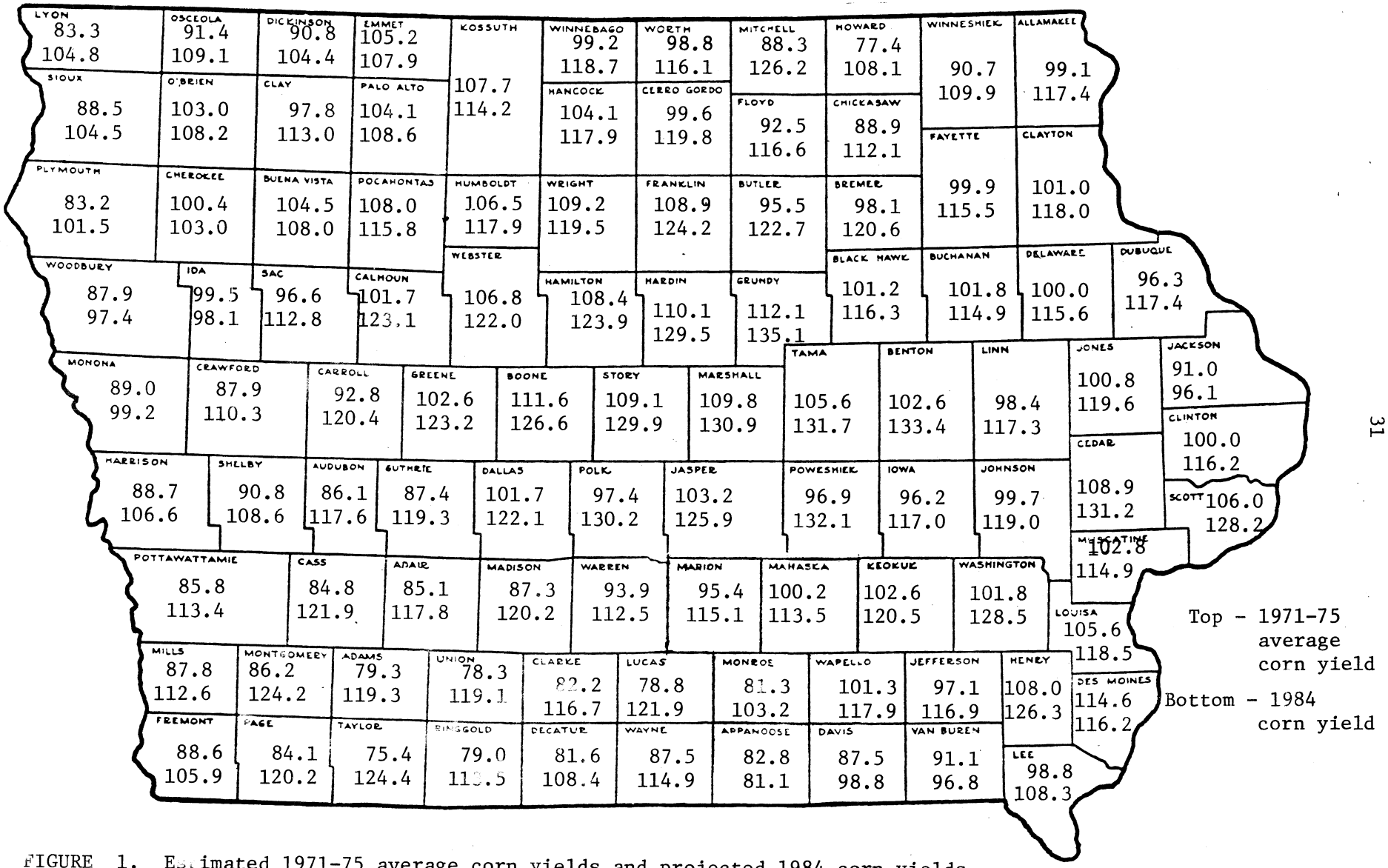
Substantial increases in corn and soybean production have occurred in Iowa since 1959. Corn production increased 24 percent from 1959 to 1974 and according to preliminary estimates, another 48 percent increase from 1974 to 1978. Corn production is projected to increase 7 percent from 1978 to 1989. Figure 1 compares the 1971-1975 average corn yield per acre with the projected 1984 corn yields per acre by counties. Figure 2 compares the average 1971-1975 total corn production by counties with the projected 1984 total corn production by counties.

In 97 out of the 99 counties in Iowa, the projected 1984 corn yields would be higher than 1971-1975 average yields. The exceptions are Ida and Appanoose counties, where the projected 1984 corn yields are slightly below their 1971-75 averages for two reasons. First, the corn yields in 1971-1973 for Ida and Appanoose counties were substantially above previous average yields. Second, this analysis assumes that level or nearly level land with high yield potential will be utilized first before row crops will be grown on steeper slopes. In these counties part of the level land tends to be poorly drained

Table 7. Estimated total grain production in 1959, 1969 and 1974, livestock production and grain sales in 1960, 1970 and 1975, projected grain production to 1984 and 1989, and projected livestock production and grain sales to 1985 and 1990 in millions of units, Iowa

Production	Estimated				Projections to	
	1959	1969	1974	1978[a]	1984	1989
Corn Production	772	933	960	1,416	1,407	1,521
Soybean Production	61	174	199	278	356	401
Oat Production	184	93	83	67	73	78
Total Grain Production	1,017	1,200	1,242	1,761	1,836	2,000
Sales	**1960**	**1970**	**1975**		**1985**	**1990**
Corn Sales	355	388	596		980	1,066
Soybean Sales	58	169	192		347	392
Oat Sales	58	32	30		28	31
Total Grain Sales	471	589	818		1,355	1,489
Livestock Numbers	**1960**	**1970**	**1975**		**1985**	**1990**
Dairy Cows	.94	.57	.39		.39	.37
Beef Cows	.99	1.44	1.93		1.76	1.93
Hogs Marketed	18.17	22.51	16.05		21.26	23.10
Grain-Fed Cattle	2.57	4.58	2.65		3.03	3.32
Sheep and Lambs	1.58	.74	.38		.32	.27
Hens and Pullets	24.64	13.24	8.61		8.24	7.88
Turkeys	7.71	5.48	6.26		5.62	5.93
Broilers	4.03	2.72	3.24		3.33	3.81

a Preliminary estimates.



Top - 1971-75 average corn yield

Bottom - 1984 corn yield

FIGURE 1. Estimated 1971-75 average corn yields and projected 1984 corn yields in bushels per acre, by counties, Iowa.

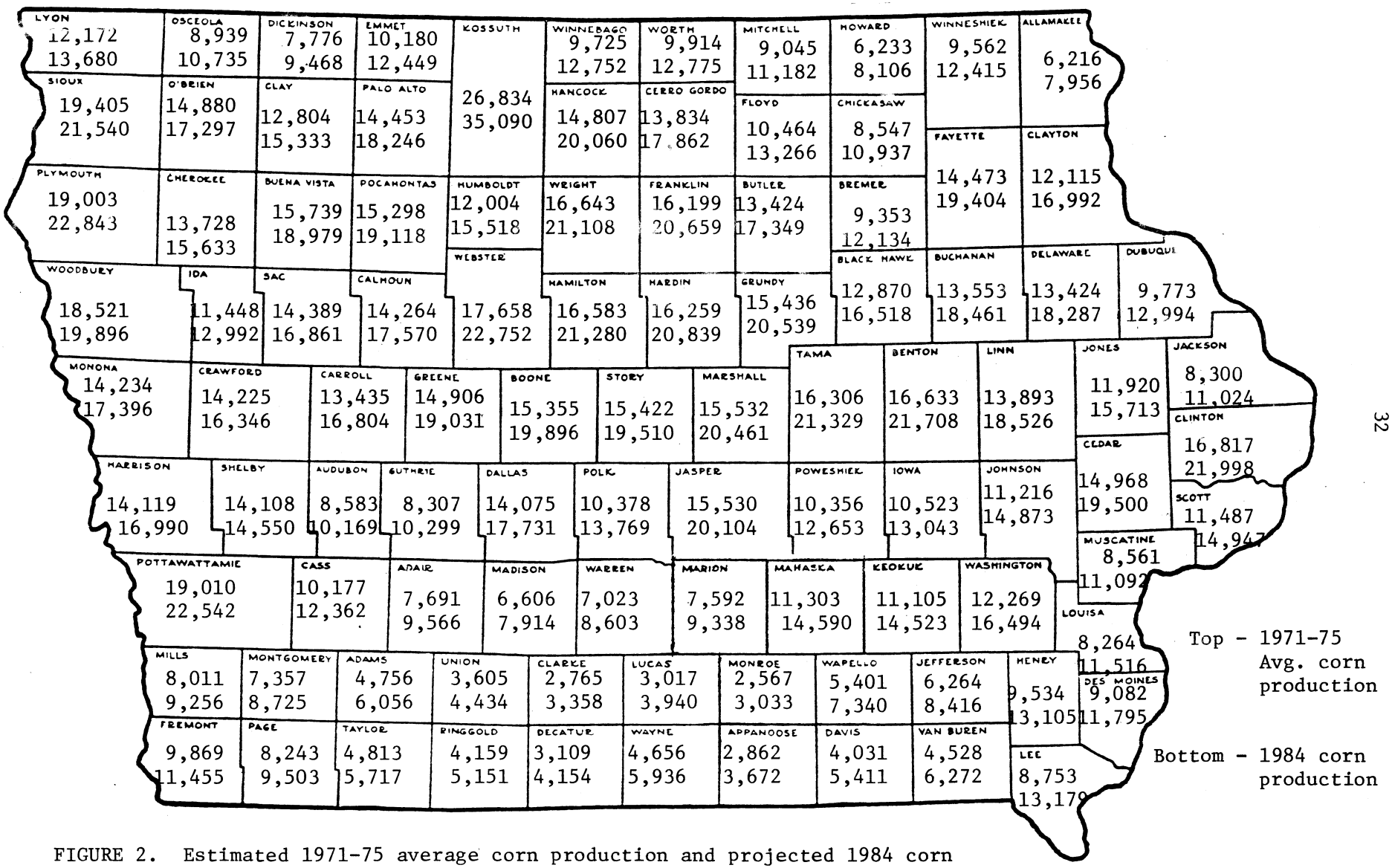


FIGURE 2. Estimated 1971-75 average corn production and projected 1984 corn production in thousands of bushels, by counties, Iowa.

or subject to periodic flooding and has not been in crop production in recent years. Projected yields on this level land are less than the projected yields on the steeper sloped land. Rising demand for grain and oilseeds is projected to bring these less productive lands into the cropping program, in future years, thus lowering county average yields slightly.

Iowa soybean production increased 226 percent from 1959 to 1974 and another 40 percent from 1974 to 1978. Soybean production in 1989 is projected to increase 44 percent from the estimated 1978 level. Oat production decreased 55 percent from 1959 to 1974 and another 19 percent from 1974 to 1978. Oat production in 1989 is projected to be 16 percent above the 1978 levels.

Grain Sales

Corn sales are projected to increase 64 percent from 1975 to 1985 and another 9 percent from 1985 to 1990. Soybean sales are projected to increase 81 and 13 percent, respectively. Oat sales in 1985 and 1990 are projected to vary only slightly from the 1975 level. These figures suggest that the percent of the total Iowa corn production sold as cash grain will increase through 1990. Almost all the increase in soybean production is expected to be sold through commercial channels. Total grain sales are projected to increase 66 percent from 1975 to 1985 and another 10 percent from 1985 to 1990. These projected

increases in grain sales are expected to substantially increase the demands on the Iowa transportation system in future years.

Fertilizer Requirements

Table 8 shows the projected increases in fertilizer nutrient consumption needed by 1984 and 1989. In terms of plant nutrients, nitrogen usage is projected to increase 14 percent, P_2O_5 usage by 77 percent, and K_2O usage by 65 percent by 1989 over the 1978 tonnages. Larger increases are projected for P_2O_5 and K_2O than for N because of requirements of the former two nutrients by soybeans, hay, and corn. In 1989, hay and pasture acreages are projected to receive 6.0 percent of the total P_2O_5 nutrients applied and 10.5 percent of the total K_2O nutrients applied.

Projected fertilizer materials consumed in 1984 and 1989 are presented in Table 9. In 1978, 57.3 percent of the total applied P_2O_5 nutrients was through direct application of diammonium phosphate (Table 5). Super-phosphate, triple superphosphate and mixed fertilizers contributed the remaining 42.7 percent of the total P_2O_5 nutrients. All of the 1989 P_2O_5 nutrients are assumed to be applied in the form of diammonium phosphate resulting in a projected 209 percent increase in the usage of diammonium phosphate from 1978 to 1989.

Direct application of muriate of potash and mixed fertilizer contributed 78.5 and 21.5 percent, respectively, of the total K_2O nutrients applied in 1978. Muriate of potash is assumed to be the sole

Table 8. Fertilizer use in Iowa, in tons of primary nutrients, N, P_2O_5, and K_2O, 1960, 1970, 1974-1978, and projections to 1984 and 1989

Year	N	P_2O_5	K_2O
1960	103,117	115,070	64,837
1970	659,435	404,696	353,570
1974	750,638	396,643	460,418
1975	746,919	424,512	442,826
1976	1,042,896	463,877	496,390
1977	852,350	417,766	478,159
1978	921,084	423,895	458,847
1984	957,072	681,159	671,803
1989	1,051,594	751,255	754,810

Table 9. Consumption of fertilizer materials and mixed grades, in thousands of tons, 1972-1978, and projections to 1984 and 1989, Iowa

	Liquid Fertilizer				Dry Fertilizer					
Year	Anhydrous Ammonia	Nitrogen Solutions	Mixed Grades and Other Materials	Total	Triple Superphosphate	Diammonium Phosphate	Muriate of Potash	Urea	Mixed Grades and Other Materials	Total
1972	484	220	299	1,003	248	216	405	56	669	1,594
1973	416	245	323	984	208	271	443	82	667	1,671
1974	555	217	319	1,091	198	336	569	75	650	1,828
1975	507	309	348	1,164	229	352	536	104	602	1,823
1976	735	491	262	1,488	198	497	637	195	478	2,005
1977	589	393	416	1,398	141	477	610	173	380	1,781
1978	654	453	369	1,476	136	528	591	176	341	1,772
1984	572	441	a	1,013	0	1,481	1,120	213	a	2,814
1989	600	521	a	1,121	0	1,633	1,258	261	a	3,152

[a] Ingredients of mixed grades are included in diammonium phosphate, muriate of potash, and urea.

source of potassium nutrients in 1989. Therefore, its usage is projected to increase 113 percent from 1978 to 1989.

Anhydrous ammonia, urea, and nitrogen solutions contributed 58.2, 8.7, and 14.1 percent, respectively, of the total nitrogen nutrients applied in 1978. Ammonium nitrate, ammonium sulfate, aqua ammonia, and mixed fertilizers contributed the remaining 19 percent of the total 1978 nitrogen nutrients applied. The 1989 nitrogen nutrient requirements are assumed to be entirely satisfied by diammonium phosphate, anhydrous ammonia, urea, and nitrogen solutions. Therefore, the 1989 usage of urea and nitrogen solution solutions are projected to increase 48 and 15 percent, respectively, over 1978 levels. However, the 1989 usage of anhydrous ammonia is projected to decrease slightly from the 1978 level.

The total consumption of fertilizer materials and mixed grades in 1989 is projected to be 32 percent above the 1978 level. The 1989 usage of dry fertilizer is projected to be 78 percent above the 1978 level. This projected increase in dry fertilizer usage is expected to increase substantially the demand for more rail, truck and (or) barge transportation.

The grain projections are based on the assumptions of approximately normal weather conditions and that production inputs will be available at prices low enough to induce farmers to produce the projected volumes. Actual fertilizer consumption in future years will depend upon environmental restrictions, available supplies, fertilizer and crop prices, and weather factors. Unless restricted by supply shortages and environmental controls, it seems that average application rates will increase further,

corresponding with the yield increases. Rates per acre are projected to increase at much slower rates than in the past, however. Factors tending to reduce the rate of increase include higher prices for all types of fertilizers and recent application rates which are closer to optimum levels.

These projected increases in grain sales and fertilizer usage are expected to result in substantially increased demands on the Iowa transportation system in the years ahead. The extent of changes in demand will vary from area to area within the state, depending on soil types, amount of marginal land being brought into crop production and other factors. These changes imply that adjustment and expansion will need to occur to accommodate the increasing demand for services of the grain and fertilizer transportation and distribution industries if Iowa is to maintain or improve its competitive position in marketing corn and soybeans. Shippers and receivers will need to plan carefully for expanded receiving, storage, and distribution facilities. These plans will need to consider the optimal size, type, and location of such facilities. Increased demand means that changes will need to be made in the modes of transportation as well as in size of shipments, rate differentials, and investments and disinvestments in the transportation system. The projections in this report should provide a starting point for this planning effort.

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APPENDIX A: GRAIN PRODUCTION AND SALES

Table A-1. Estimated corn production in 1959, 1969, and 1974, and projections to 1984 and 1989 in thousands of bushels, by counties, Iowa

County	Estimated			Projections to	
	1959	1969	1974	1984	1989
Adair	5,856	6,732	5,387	9,566	10,268
Adams	3,710	4,613	2,563	6,056	6,481
Allamakee	3,750	4,978	5,975	7,956	8,787
Appanoose	2,214	2,365	2,407	3,672	3,949
Audubon	6,375	7,561	6,479	10,169	10,889
Benton	13,211	14,643	16,651	21,708	23,364
Black Hawk	9,885	8,867	13,264	16,518	17,928
Boone	10,056	11,861	14,667	19,896	21,808
Bremer	6,596	6,344	9,813	12,134	13,291
Buchanan	9,026	9,979	13,817	18,461	20,399
Buena Vista	10,905	12,685	15,034	18,979	20,000
Butler	10,246	9,267	12,361	17,349	18,874
Calhoun	9,974	11,308	14,882	17,570	19,034
Carroll	9,370	12,363	12,290	16,804	18,062
Cass	7,135	9,284	6,314	12,362	13,279
Cedar	10,517	14,688	13,298	19,500	21,041
Cerro Gordo	10,588	10,883	13,395	17,862	19,419
Cherokee	9,018	11,849	12,453	15,633	16,873
Chickasaw	6,191	6,071	7,688	10,937	11,940
Clarke	2,102	1,903	1,851	3,358	3,591
Clay	9,144	11,213	9,791	15,333	16,549
Clayton	6,141	9,609	11,525	16,992	19,076
Clinton	12,467	16,957	13,035	21,998	23,700
Crawford	10,044	11,838	10,834	16,346	17,571
Dallas	8,965	10,734	12,005	17,731	19,361
Davis	2,438	3,255	3,514	5,411	5,994
Decatur	1,857	2,328	2,207	4,154	4,523
Delaware	7,774	10,071	12,538	18,287	20,199
Des Moines	5,593	6,097	8,231	11,795	12,939
Dickinson	3,912	7,077	5,319	9,468	10,246
Dubuque	6,122	8,045	8,762	12,994	14,214
Emmet	5,942	8,157	9,200	12,449	13,107
Fayette	8,777	10,236	14,773	19,404	21,517
Floyd	8,650	8,653	8,512	13,266	14,307
Franklin	12,784	12,683	15,460	20,659	22,350
Fremont	7,894	8,748	5,963	11,455	12,191
Greene	9,562	12,814	14,022	19,031	20,591
Grundy	11,431	12,049	15,371	20,539	22,370
Guthrie	6,478	7,142	6,055	10,299	11,046
Hamilton	12,453	12,585	15,526	21,280	23,062
Hancock	10,081	12,390	14,088	20,060	21,687
Hardin	12,153	12,302	16,496	20,839	22,697
Harrison	10,102	12,697	9,000	16,990	18,331
Henry	5,627	7,517	9,034	13,105	14,497
Howard	5,382	4,896	4,154	8,106	8,874
Humboldt	8,561	10,586	11,623	15,518	16,319
Ida	6,931	9,076	9,987	12,992	13,579
Iowa	7,622	8,003	8,744	13,043	14,045
Jackson	5,709	7,757	6,246	11,024	11,946
Jasper	10,169	13,443	13,293	20,104	21,793
Jefferson	4,133	4,542	5,494	8,416	9,261

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Table A-1. continued

County	Estimated			Projections to	
	1959	1969	1974	1984	1989
Johnson	7,814	10,008	9,800	14,873	16,142
Jones	8,157	9,974	10,468	15,713	17,034
Keokuk	6,728	7,865	10,236	14,523	15,953
Kossuth	17,002	23,571	26,567	35,090	37,033
Lee	4,992	7,230	7,613	13,179	14,816
Linn	9,849	11,802	12,515	18,526	20,066
Louisa	5,535	7,065	7,766	11,516	12,592
Lucas	1,896	2,490	1,976	3,940	4,280
Lyon	7,491	13,128	6,790	13,680	14,643
Madison	5,116	5,350	4,678	7,914	8,451
Mahaska	7,556	8,343	10,276	14,590	15,853
Marion	4,985	5,226	5,900	9,338	10,060
Marshall	10,601	13,224	15,691	20,461	22,331
Mills	7,146	8,117	5,023	9,256	9,799
Mitchell	7,688	7,501	6,207	11,182	12,049
Monona	8,742	12,932	9,673	17,396	19,006
Monroe	1,666	1,421	1,914	3,033	3,285
Montgomery	5,207	6,896	5,036	8,725	9,278
Muscatine	6,363	7,711	7,233	11,092	12,003
O'Brien	9,434	15,092	11,667	17,297	18,714
Osceola	5,810	9,345	5,221	10,735	11,567
Page	6,100	7,634	4,547	9,503	10,111
Palo Alto	9,625	11,722	13,997	18,246	19,185
Plymouth	12,844	16,793	14,717	22,843	24,769
Pocahontas	10,737	12,628	15,383	19,118	20,804
Polk	7,262	9,358	8,292	13,769	14,960
Pottawattamie	15,640	18,967	10,592	22,542	24,015
Poweshiek	7,563	8,276	9,066	12,653	13,518
Ringgold	2,834	2,866	2,008	5,151	5,602
Sac	9,726	12,119	13,742	16,861	18,160
Scott	7,643	11,717	8,759	14,947	16,184
Shelby	10,556	11,693	10,561	14,550	14,705
Sioux	12,224	20,582	16,127	21,540	23,054
Story	12,319	12,514	15,320	19,510	21,170
Tama	10,958	12,922	15,976	21,329	23,145
Taylor	3,506	4,147	2,127	5,717	6,133
Union	2,982	3,153	1,968	4,434	4,722
Van Buren	2,820	3,449	3,797	6,272	6,927
Wapello	3,614	3,804	5,057	7,340	8,106
Warren	4,303	4,391	5,043	8,603	9,303
Washington	8,111	10,428	10,368	16,494	18,003
Wayne	2,743	3,532	3,430	5,936	6,477
Webster	12,217	13,082	18,349	22,752	24,807
Winnebago	7,679	8,355	8,751	12,752	13,848
Winneshiek	6,191	7,858	9,067	12,415	13,690
Woodbury	11,678	14,218	14,271	19,896	21,522
Worth	6,813	7,102	9,073	12,775	14,076
Wright	11,797	13,558	15,971	21,108	22,217
Total	771,886	932,903	960,000	1,406,693	1,521,387

Table A-2. Estimated soybean production in 1959, 1969, and 1974, and projections to 1984 and 1989 in thousands of bushels, by counties, Iow

County	Estimated			Projections to	
	1959	1969	1974	1984	1989
Adair	231	1,350	1,366	2,889	3,343
Adams	189	906	797	1,650	1,849
Allamakee	7	79	115	297	380
Appanoose	515	887	664	1,346	1,447
Audubon	53	842	1,091	2,735	3,418
Benton	332	2,586	3,654	6,774	8,156
Black Hawk	408	1,732	2,782	4,353	5,057
Boone	1,157	2,720	3,342	5,479	6,078
Bremer	237	1,138	1,723	2,753	3,192
Buchanan	266	1,605	2,437	3,884	4,540
Buena Vista	1,141	2,766	3,641	5,654	6,052
Butler	421	1,626	2,382	4,015	4,642
Calhoun	2,073	3,575	4,224	6,201	6,696
Carroll	569	2,007	2,591	4,276	4,846
Cass	110	1,234	1,579	3,384	4,138
Cedar	167	1,675	2,228	5,174	6,437
Cerro Gordo	657	2,214	2,869	4,913	5,599
Cherokee	838	2,097	2,409	3,696	4,084
Chickasaw	344	1,110	1,580	2,445	2,753
Clarke	257	565	546	1,068	1,170
Clay	1,127	2,891	2,954	5,180	5,754
Clayton	7	74	182	355	461
Clinton	174	1,367	1,597	3,866	4,729
Crawford	84	1,292	1,705	4,475	5,695
Dallas	1,231	2,685	2,644	4,272	4,642
Davis	492	788	696	1,350	1,481
Decatur	241	610	551	1,031	1,113
Delaware	57	466	879	1,932	2,418
Des Moines	602	1,339	1,390	2,464	2,761
Dickinson	504	1,622	1,797	3,139	3,543
Dubuque	1	50	87	378	563
Emmet	954	2,154	2,666	3,911	4,165
Fayette	445	1,285	2,103	2,913	3,310
Floyd	443	1,958	2,280	4,189	4,805
Franklin	684	2,629	3,393	6,187	7,186
Fremont	476	1,963	2,285	3,542	3,934
Greene	1,589	3,390	3,639	5,631	6,107
Grundy	685	2,389	3,175	5,374	6,162
Guthrie	491	1,562	1,595	3,014	3,367
Hamilton	1,555	3,374	3,498	6,467	7,127
Hancock	1,142	3,041	3,655	6,313	7,014
Hardin	734	2,780	3,021	5,852	6,692
Harrison	581	2,157	2,077	3,486	3,886
Henry	500	1,588	1,615	3,039	3,453
Howard	360	990	1,268	2,045	2,301
Humboldt	1,214	2,894	3,298	5,206	5,564
Ida	254	1,260	1,451	2,797	3,107
Iowa	193	959	1,110	2,598	3,092
Jackson	15	156	173	533	660
Jasper	532	2,138	2,117	4,604	5,333
Jefferson	644	1,351	1,354	2,431	2,693

(cont. on next page)

Table A-2. continued

County	Estimated			Projections to	
	1959	1969	1974	1984	1989
Johnson	290	1,150	1,576	3,006	3,507
Jones	59	707	1,091	2,775	3,521
Keokuk	705	1,397	1,496	2,649	2,923
Kossuth	2,620	6,206	7,633	11,060	11,776
Lee	624	1,046	1,121	2,135	2,391
Linn	288	1,730	2,296	4,484	5,320
Louisa	603	1,506	1,428	2,602	2,903
Lucas	301	603	481	1,068	1,163
Lyon	538	1,570	1,842	3,024	3,387
Madison	565	1,536	1,036	2,325	2,551
Mahaska	658	1,887	1,845	3,601	4,039
Marion	442	1,061	1,000	2,267	2,511
Marshall	534	2,216	2,312	4,547	5,220
Mills	179	1,767	1,917	3,552	3,940
Mitchell	388	1,344	1,822	3,174	3,645
Monona	1,156	2,084	1,703	2,888	3,135
Monroe	277	387	356	793	857
Montgomery	167	1,389	1,625	3,165	3,619
Muscatine	460	1,163	1,453	2,420	2,731
O'Brien	1,450	3,314	3,234	5,294	5,824
Osceola	822	1,841	1,795	3,284	3,639
Page	291	1,820	1,973	3,515	3,874
Palo Alto	1,386	3,327	4,052	6,333	6,759
Plymouth	489	1,827	2,446	4,229	4,872
Pocahontas	1,871	4,127	4,518	7,097	7,506
Polk	1,158	2,468	1,959	3,781	4,107
Pottawattamie	293	2,674	3,161	6,738	8,099
Poweshiek	362	1,734	1,837	3,899	4,545
Ringgold	422	737	774	1,452	1,588
Sac	776	2,251	2,668	4,326	4,819
Scott	209	1,194	1,202	2,709	3,180
Shelby	44	1,163	1,765	4,981	5,529
Sioux	748	1,883	2,270	3,313	3,672
Story	1,044	3,002	2,963	5,688	6,334
Tama	496	2,204	3,050	5,687	6,680
Taylor	420	1,121	1,048	1,958	2,156
Union	217	633	572	1,168	1,284
Van Buren	688	947	834	1,426	1,550
Wapello	700	1,190	1,182	2,074	2,279
Warren	662	1,168	975	1,948	2,079
Washington	586	1,926	1,818	3,750	4,247
Wayne	483	892	837	1,598	1,737
Webster	2,492	4,407	4,942	7,987	8,660
Winnebago	710	2,075	2,403	4,466	5,018
Winneshiek	59	316	421	822	981
Woodbury	753	1,718	1,777	2,782	3,070
Worth	701	1,715	1,934	3,138	3,488
Wright	1,546	3,918	4,362	7,009	7,485
Total	60,715	174,257	199,080	355,547	401,195

Table A-3. Estimated oat production in 1959, 1969, and 1974, and projections to 1984 and 1989 in thousands of bushels, by counties, Iowa

County	Estimated			Projections to	
	1959	1969	1974	1984	1989
Adair	1,610	959	804	801	867
Adams	884	488	456	452	492
Allamakee	1,529	1,286	1,194	1,255	1,397
Appanoose	151	259	255	207	227
Audubon	1,585	945	732	735	793
Benton	3,620	1,927	1,608	1,428	1,521
Black Hawk	2,293	835	927	753	797
Boone	2,497	846	640	557	577
Bremer	1,973	891	1,029	953	1,039
Buchanan	2,336	1,138	1,246	1,082	1,184
Buena Vista	2,962	1,021	866	304	281
Butler	2,289	1,052	1,170	1,076	1,170
Calhoun	2,591	623	680	463	474
Carroll	2,552	1,075	1,150	929	985
Cass	1,717	823	638	602	637
Cedar	2,861	1,624	1,149	1,119	1,188
Cerro Gordo	2,342	887	748	582	606
Cherokee	2,468	1,244	934	761	806
Chickasaw	1,942	1,052	1,017	1,073	1,184
Clarke	474	424	300	386	426
Clay	2,589	908	686	521	539
Clayton	2,397	2,034	1,927	1,967	2,190
Clinton	2,782	1,803	1,287	1,268	1,353
Crawford	2,971	1,618	1,749	1,527	1,676
Dallas	1,942	617	434	352	359
Davis	180	357	295	295	327
Decatur	236	263	274	218	238
Delaware	2,383	1,889	1,961	1,822	2,030
Des Moines	683	319	274	211	221
Dickinson	1,305	713	446	372	391
Dubuque	2,253	1,889	2,153	2,067	2,315
Emmet	1,590	492	300	215	214
Fayette	2,583	1,531	1,823	1,697	1,889
Floyd	2,072	808	675	604	636
Franklin	2,542	908	756	610	631
Fremont	346	45	102	31	32
Greene	2,333	569	457	321	327
Grundy	2,362	804	866	677	710
Guthrie	1,533	751	593	590	630
Hamilton	2,827	560	488	366	369
Hancock	2,605	961	1,017	731	374
Hardin	2,585	670	621	454	464
Harrison	1,214	565	623	466	504
Henry	791	390	411	327	348
Howard	1,943	1,145	942	1,078	1,194
Humboldt	2,043	574	476	99	108
Ida	2,047	1,174	1,008	837	902
Iowa	1,635	1,295	903	996	1,086
Jackson	1,530	1,414	1,217	1,288	1,426
Jasper	2,375	1,346	1,187	1,182	1,278
Jefferson	611	477	463	453	499

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Table A-3. continued

County	Estimated			Projections to	
	1959	1969	1974	1984	1989
Johnson	1,880	1,157	925	883	950
Jones	1,873	1,326	1,111	1,042	1,128
Keokuk	1,318	756	667	646	703
Kossuth	4,456	1,505	1,158	498	528
Lee	189	179	204	150	157
Linn	2,423	1,358	1,007	986	1,048
Louisa	902	366	242	221	228
Lucas	313	356	329	313	346
Lyon	2,601	2,335	1,936	1,794	1,973
Madison	1,200	588	534	485	518
Mahaska	1,703	876	947	844	923
Marion	1,099	543	588	593	644
Marshall	2,340	763	782	659	690
Mills	758	177	228	104	106
Mitchell	2,397	1,325	898	1,025	1,095
Monona	924	611	618	509	561
Monroe	250	123	334	208	231
Montgomery	1,080	318	339	219	227
Muscatine	1,231	741	554	492	525
O'Brien	2,744	1,630	986	931	986
Osceola	1,479	1,375	871	872	951
Page	845	328	352	247	264
Palo Alto	2,808	859	749	441	467
Plymouth	4,280	2,777	3,046	2,517	2,757
Pocahontas	2,813	730	521	377	191
Polk	1,372	435	325	341	359
Pottawattamie	2,955	1,321	720	677	705
Poweshiek	1,860	1,229	1,136	1,134	1,240
Ringgold	334	355	390	383	427
Sac	2,789	1,075	1,113	790	827
Scott	1,640	1,019	749	705	749
Shelby	2,726	1,470	1,464	1,367	1,448
Sioux	4,109	2,498	2,355	1,859	2,011
Story	2,654	491	363	282	281
Tama	2,682	1,266	1,207	1,123	1,197
Taylor	631	498	487	454	497
Union	660	475	423	432	477
Van Buren	159	273	307	292	328
Wapello	489	338	304	321	357
Warren	963	376	447	432	465
Washington	1,753	847	564	592	627
Wayne	412	548	434	440	486
Webster	3,018	624	504	363	364
Winnebago	1,610	776	476	431	450
Winneshiek	2,645	2,261	2,226	2,262	2,532
Woodbury	2,202	1,580	1,549	1,294	1,420
Worth	1,754	840	568	584	620
Wright	2,802	715	506	234	248
Total	184,089	92,700	82,500	73,008	78,223

Table A-4. Estimated amount of corn remaining after substracting on-farm usage in 1960, 1970, and 1975, and projections to 1985 and 1990 in thousands of bushels, by counties, Iowa

County	Estimated			Projections to	
	1960	1970	1975	1985	1990
Adair	2,203	2,083	2,293	5,799	6,233
Adams	1,307	1,533	573	3,700	3,956
Allamakee	- 667	127	2,436	3,864	4,531
Appanoose	658	905	1,614	2,699	2,935
Audubon	2,257	1,518	2,742	5,647	6,051
Benton	6,468	6,653	11,570	15,729	17,054
Black Hawk	4,781	4,379	10,012	13,240	14,554
Boone	6,514	6,715	11,845	16,583	18,321
Bremer	2,066	1,969	7,224	8,952	10,030
Buchanan	4,133	4,468	9,741	13,805	15,444
Buena Vista	5,554	5,627	10,046	12,954	13,425
Butler	5,207	3,080	8,483	12,343	13,529
Calhoun	6,967	6,498	12,028	13,884	15,075
Carroll	3,963	2,379	5,236	8,571	9,059
Cass	2,765	3,183	2,405	7,996	8,635
Cedar	2,831	5,185	7,143	12,194	13,276
Cerro Gordo	6,625	6,208	10,084	13,969	15,262
Cherokee	2,963	3,904	7,205	9,930	10,842
Chickasaw	2,546	2,011	5,213	8,015	8,928
Clarke	659	223	818	1,969	2,104
Clay	5,609	6,224	6,483	11,884	12,937
Clayton	- 815	1,197	5,085	9,592	11,228
Clinton	4,604	6,398	6,843	14,835	16,145
Crawford	4,004	2,039	4,672	8,686	9,288
Dallas	5,595	6,158	9,657	14,793	16,275
Davis	565	966	2,037	3,489	3,923
Decatur	318	973	1,362	3,030	3,339
Delaware	365	181	4,808	8,655	9,794
Des Moines	3,061	3,646	6,514	9,958	11,014
Dickinson	1,896	4,378	3,502	7,623	8,309
Dubuque	- 820	- 996	1,684	5,062	5,753
Emmet	3,839	5,189	7,591	10,488	11,042
Fayette	2,566	3,188	9,909	13,685	15,512
Floyd	5,512	5,354	6,315	10,799	11,726
Franklin	7,284	5,998	11,170	15,579	16,949
Fremont	6,097	6,135	4,433	9,684	10,299
Greene	7,072	9,134	12,100	16,512	17,929
Grundy	6,515	5,877	11,865	16,187	17,778
Guthrie	3,651	2,496	3,066	6,615	7,054
Hamilton	6,818	6,380	9,958	16,062	17,456
Hancock	5,990	7,409	10,565	15,814	17,005
Hardin	6,769	3,637	11,865	14,858	16,291
Harrison	7,462	9,192	7,045	14,494	15,683
Henry	1,916	3,365	5,644	9,405	10,538
Howard	2,501	1,675	1,969	5,557	6,239
Humboldt	5,768	7,458	9,753	13,459	14,190
Ida	2,525	1,909	5,857	8,075	8,343
Iowa	1,841	1,120	3,881	7,199	7,779
Jackson	1,204	775	1,234	5,319	5,818
Jasper	4,106	5,584	8,287	14,179	15,469
Jefferson	1,660	1,590	3,355	5,941	6,594

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Table A-4. continued

County	Estimated			Projections to	
	1960	1970	1975	1985	1990
Johnson	1,659	2,602	3,750	7,761	8,443
Jones	1,508	1,918	4,621	9,101	9,976
Keokuk	2,155	1,230	5,457	8,249	9,070
Kossuth	10,719	15,249	20,301	28,130	29,594
Lee	2,127	3,790	5,219	10,260	11,678
Linn	4,378	6,751	8,989	14,520	15,883
Louisa	2,279	4,318	5,944	9,482	10,473
Lucas	277	641	890	2,292	2,497
Lyon	2,103	4,778	973	7,057	7,517
Madison	2,568	2,263	2,737	5,316	5,668
Mahaska	2,026	877	4,290	7,620	8,280
Marion	877	- 2	2,049	4,765	5,115
Marshall	5,946	7,658	12,966	16,917	18,630
Mills	4,778	4,813	3,039	7,024	7,440
Mitchell	4,532	3,510	2,792	7,685	8,308
Monona	6,180	9,060	7,084	14,365	15,725
Monroe	286	40	1,063	1,916	2,111
Montgomery	1,979	2,175	2,527	5,477	5,829
Muscatine	2,785	3,432	4,452	7,697	8,391
O'Brien	3,952	6,676	6,047	11,312	12,308
Osceola	2,763	5,041	2,449	7,714	8,383
Page	1,851	2,270	1,296	5,521	5,865
Palo Alto	6,526	7,186	11,322	14,995	15,745
Plymouth	4,207	3,157	4,915	11,769	12,794
Pocahontas	6,839	7,019	12,452	15,243	16,682
Polk	5,235	7,299	7,383	12,482	13,630
Pottawattamie	6,548	6,760	2,890	14,126	15,144
Poweshiek	2,922	2,841	5,283	8,208	8,765
Ringgold	1,054	532	511	3,111	3,372
Sac	3,708	1,567	7,726	9,590	10,360
Scott	2,886	6,018	5,029	10,371	11,322
Shelby	5,396	3,981	6,016	8,761	8,472
Sioux	2,882	3,323	1,933	7,039	7,246
Story	8,778	7,897	12,530	16,221	17,706
Tama	4,988	5,397	12,051	16,275	17,843
Taylor	858	625	- 30	2,963	3,165
Union	1,111	926	554	2,648	2,810
Van Buren	1,190	1,492	2,238	4,448	4,933
Wapello	1,842	1,855	3,330	5,509	6,124
Warren	1,949	1,675	2,745	5,952	6,438
Washington	1,212	2,347	3,452	8,664	9,530
Wayne	901	1,271	2,033	4,171	4,572
Webster	9,783	8,560	15,440	19,535	21,333
Winnebago	4,860	5,647	7,161	10,626	11,624
Winneshiek	- 484	731	4,027	6,366	7,387
Woodbury	5,212	5,056	7,630	12,358	13,363
Worth	4,131	4,322	7,476	10,878	12,105
Wright	7,749	9,326	13,295	17,990	18,941
Total	355,289	388,177	595,547	979,841	1,065,533

Table A-5. Estimated amount of soybeans remaining after subtracting on-farm usage in 1960, 1970, and 1975, and projections to 1985 and 1990 in thousands of bushels, by counties, Iowa

County	Estimated			Projections to	
	1960	1970	1975	1985	1990
Adair	223	1,306	1,314	2,819	3,267
Adams	182	875	765	1,611	1,807
Allamakee	7	77	111	290	371
Appanoose	491	855	628	1,298	1,399
Audubon	51	816	1,051	2,668	3,338
Benton	321	2,518	3,548	6,629	7,991
Black Hawk	393	1,675	2,695	4,246	4,940
Boone	1,117	2,634	3,232	5,355	5,948
Bremer	227	1,098	1,664	2,687	3,121
Buchanan	255	1,551	2,358	3,788	4,434
Buena Vista	1,103	2,674	3,528	5,505	5,901
Butler	405	1,567	2,294	3,921	4,540
Calhoun	2,000	3,452	4,086	6,057	6,549
Carroll	545	1,940	2,507	4,175	4,737
Cass	106	1,196	1,523	3,305	4,046
Cedar	161	1,633	2,158	5,061	6,304
Cerro Gordo	631	2,141	2,766	4,796	5,473
Cherokee	809	2,039	2,330	3,593	3,977
Chickasaw	327	1,064	1,512	2,383	2,687
Clarke	245	541	519	1,042	1,143
Clay	1,086	2,808	2,846	5,049	5,616
Clayton	7	71	176	347	451
Clinton	167	1,332	1,540	3,771	4,619
Crawford	81	1,253	1,648	4,359	5,554
Dallas	1,188	2,606	2,550	4,172	4,540
Davis	470	760	660	1,311	1,440
Decatur	227	588	524	1,004	1,085
Delaware	55	450	848	1,884	2,362
Des Moines	581	1,303	1,337	2,404	2,697
Dickinson	479	1,571	1,728	3,053	3,452
Dubuque	1	49	84	369	550
Emmet	914	2,087	2,579	3,808	4,061
Fayette	426	1,238	2,031	2,841	3,233
Floyd	424	1,890	2,188	4,086	4,694
Franklin	661	2,552	3,287	6,044	7,029
Fremont	460	1,910	2,208	3,446	3,834
Greene	1,525	3,286	3,517	5,500	5,973
Grundy	663	2,320	3,084	5,260	6,039
Guthrie	472	1,509	1,533	2,942	3,290
Hamilton	1,503	3,265	3,367	6,318	6,972
Hancock	1,098	2,947	3,533	6,160	6,853
Hardin	711	2,701	2,920	5,723	6,553
Harrison	551	2,096	2,002	3,393	3,787
Henry	482	1,544	1,559	2,970	3,379
Howard	343	945	1,200	1,991	2,244
Humboldt	1,174	2,812	3,196	5,080	5,436
Ida	245	1,223	1,402	2,716	3,021
Iowa	185	929	1,065	2,535	3,021
Jackson	14	152	166	518	641
Jasper	511	2,079	2,034	4,499	5,219
Jefferson	620	1,308	1,301	2,372	2,630

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Table A-5. continued

County	Estimated			Projections to	
	1960	1970	1975	1985	1990
Johnson	280	1,118	1,519	2,934	3,427
Jones	57	687	1,053	2,709	3,441
Keokuk	679	1,350	1,437	2,586	2,857
Kossuth	2,522	6,024	7,388	10,784	11,499
Lee	599	1,011	1,072	2,079	2,331
Linn	277	1,679	2,217	4,375	5,197
Louisa	580	1,462	1,373	2,539	2,837
Lucas	287	578	456	1,043	1,137
Lyon	514	1,523	1,773	2,942	3,299
Madison	545	1,490	987	2,270	2,494
Mahaska	633	1,831	1,774	3,511	3,943
Marion	423	1,026	954	2,211	2,453
Marshall	516	2,157	2,234	4,447	5,113
Mills	173	1,720	1,853	3,462	3,845
Mitchell	371	1,295	1,740	3,102	3,568
Monona	1,098	2,018	1,626	2,804	3,050
Monroe	265	370	335	771	834
Montgomery	161	1,351	1,570	3,092	3,540
Muscatine	441	1,130	1,402	2,360	2,667
O'Brien	1,399	3,226	3,118	5,154	5,679
Osceola	786	1,786	1,718	3,198	3,549
Page	281	1,769	1,902	3,431	3,787
Palo Alto	1,336	3,223	3,918	6,166	6,592
Plymouth	470	1,768	2,371	4,110	4,742
Pocahontas	1,806	4,002	4,371	6,922	7,331
Polk	1,113	2,391	1,874	3,698	4,022
Pottawattamie	281	2,603	3,054	6,568	7,904
Poweshiek	349	1,685	1,770	3,814	4,452
Ringgold	402	708	736	1,415	1,550
Sac	748	2,178	2,583	4,216	4,704
Scott	202	1,164	1,158	2,649	3,113
Shelby	43	1,125	1,708	4,850	5,391
Sioux	719	1,828	2,200	3,222	3,577
Story	1,008	2,913	2,846	5,563	6,203
Tama	478	2,143	2,955	5,564	6,544
Taylor	402	1,081	1,000	1,913	2,110
Union	208	611	546	1,140	1,255
Van Buren	661	913	797	1,384	1,507
Wapello	673	1,150	1,135	2,024	2,226
Warren	633	1,125	929	1,899	2,029
Washington	566	1,873	1,745	3,667	4,158
Wayne	461	859	794	1,558	1,696
Webster	2,405	4,259	4,779	7,800	8,468
Winnebago	683	2,009	2,310	4,359	4,904
Winneshiek	56	304	403	801	957
Woodbury	715	1,663	1,713	2,700	2,985
Worth	671	1,655	1,855	3,060	3,407
Wright	1,494	3,802	4,222	6,841	7,317
Total	58,393	168,872	191,975	346,861	391,939

Table A-6. Estimated amount of oats remaining after subtracting on-farm usage in 1960, 1970, and 1975, and projections to 1985 and 1990 in thousands of bushels, by counties, Iowa

County	Estimated			Projections to	
	1960	1970	1975	1985	1990
Adair	424	304	274	294	326
Adams	241	160	160	171	191
Allamakee	135	136	136	154	176
Appanoose	46	94	99	87	98
Audubon	365	262	218	236	261
Benton	1,298	831	745	713	778
Black Hawk	755	331	394	345	375
Boone	1,089	444	361	338	359
Bremer	467	254	315	314	351
Buchanan	734	430	506	474	531
Buena Vista	1,089	451	411	155	147
Butler	660	365	436	432	481
Calhoun	1,303	376	442	324	340
Carroll	768	389	447	390	423
Cass	431	248	207	211	228
Cedar	815	556	423	444	483
Cerro Gordo	771	351	318	267	285
Cherokee	710	430	347	305	331
Chickasaw	346	225	234	266	301
Clarke	153	164	125	173	196
Clay	959	404	328	269	285
Clayton	220	224	228	251	287
Clinton	688	536	411	437	478
Crawford	759	497	577	543	611
Dallas	883	337	255	223	233
Davis	47	112	99	107	122
Decatur	83	111	124	107	119
Delaware	348	331	370	370	423
Des Moines	266	149	138	114	122
Dickinson	498	327	220	198	213
Dubuque	319	321	394	408	468
Emmet	675	251	165	127	130
Fayette	474	338	432	434	494
Floyd	629	295	265	255	275
Franklin	894	384	343	299	317
Fremont	87	14	33	11	11
Greene	1,024	300	259	196	205
Grundy	883	361	418	352	379
Guthrie	516	304	258	276	302
Hamilton	1,354	323	302	244	252
Hancock	888	394	448	347	182
Hardin	856	267	266	209	219
Harrison	443	248	294	237	262
Henry	270	160	181	155	169
Howard	322	228	201	249	282
Humboldt	793	268	239	54	60
Ida	517	357	329	295	325
Iowa	457	435	326	388	433
Jackson	265	295	273	311	353
Jasper	879	599	568	609	675
Jefferson	218	205	214	226	255

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Table A-6. continued

County	Estimated			Projections to	
	1960	1970	1975	1985	1990
Johnson	493	365	314	323	356
Jones	392	334	300	304	337
Keokuk	377	260	246	257	287
Kossuth	1,765	717	593	275	299
Lee	47	54	65	52	56
Linn	977	658	525	554	603
Louisa	351	171	122	119	127
Lucas	93	127	126	130	147
Lyon	771	832	741	741	834
Madison	436	257	251	245	269
Mahaska	471	291	339	325	364
Marion	326	194	225	245	272
Marshall	885	347	382	348	372
Mills	278	78	108	53	56
Mitchell	384	255	186	229	250
Monona	319	254	276	245	277
Monroe	54	32	93	63	71
Montgomery	224	79	91	63	67
Muscatine	375	271	218	209	228
O'Brien	803	574	373	380	412
Osceola	509	570	388	419	467
Page	150	70	81	61	67
Palo Alto	1,182	435	407	258	280
Plymouth	1,150	897	1,058	943	1,058
Pocahontas	1,242	388	297	232	120
Polk	631	240	193	219	236
Pottawattamie	889	478	280	284	303
Poweshiek	608	482	479	516	578
Ringgold	90	116	136	145	165
Sac	1,003	465	517	396	424
Scott	470	351	277	281	306
Shelby	941	610	653	657	714
Sioux	940	687	696	593	657
Story	1,124	250	199	166	170
Tama	883	501	514	515	562
Taylor	148	141	148	149	167
Union	192	166	159	175	198
Van Buren	51	104	126	129	149
Wapello	223	186	179	204	233
Warren	371	174	223	232	256
Washington	474	276	197	223	242
Wayne	130	207	177	193	219
Webster	1,617	402	349	271	278
Winnebago	527	306	201	197	210
Winneshiek	240	247	261	286	328
Woodbury	666	575	606	546	613
Worth	523	301	219	243	264
Wright	1,262	387	294	147	160
Total	58,171	32,338	30,444	28,234	30,710

Table A-7. Estimated corn acres in 1959, 1969, and 1974, and projections to 1984 and 1989 in thousands of acres, by counties, Iowa

County	Estimated			Projections to	
	1959	1969	1974	1984	1989
Adair	93.6	76.6	94.0	81.2	82.2
Adams	62.7	54.7	60.3	50.7	51.1
Allamakee	56.6	51.0	68.0	67.8	70.3
Appanoose	41.7	29.3	35.1	45.3	45.9
Audubon	96.5	77.4	106.2	86.5	88.5
Benton	171.3	143.6	168.2	162.7	166.0
Black Hawk	136.0	106.9	136.7	142.1	145.3
Boone	144.0	113.3	146.8	157.1	162.6
Bremer	96.0	71.4	103.0	100.6	104.2
Buchanan	135.4	107.3	141.2	160.7	167.3
Buena Vista	157.8	124.8	163.1	175.8	174.8
Butler	151.7	114.6	145.4	141.4	145.2
Calhoun	152.6	114.1	152.1	142.8	146.0
Carroll	145.2	127.7	154.4	139.5	141.8
Cass	110.2	99.8	124.4	101.4	103.2
Cedar	138.0	133.4	139.2	148.6	151.7
Cerro Gordo	164.1	112.0	152.6	149.1	153.0
Cherokee	143.4	113.6	147.7	151.8	154.7
Chickasaw	107.5	74.1	102.7	97.6	100.1
Clarke	43.0	29.6	35.5	28.8	29.1
Clay	150.2	104.9	137.9	135.7	138.2
Clayton	196.8	103.0	124.4	144.0	152.2
Clinton	166.0	153.8	171.5	189.3	192.6
Crawford	154.4	122.7	173.3	148.2	152.8
Dallas	134.9	105.3	145.5	145.2	149.5
Davis	47.2	42.8	45.9	54.8	57.2
Decatur	47.0	32.9	36.5	38.3	39.5
Delaware	119.9	110.0	138.2	158.1	164.8
Des Moines	73.0	60.5	82.2	101.5	105.0
Dickinson	97.0	69.0	88.4	90.7	92.6
Dubuque	89.8	87.5	103.3	110.6	114.6
Emmet	111.4	76.8	102.5	115.3	114.6
Fayette	142.2	113.5	157.7	168.0	175.5
Floyd	136.3	91.7	119.3	113.8	115.9
Franklin	174.5	123.8	155.5	166.3	170.9
Fremont	135.5	88.7	117.6	108.2	108.6
Greene	151.2	122.5	157.6	154.5	157.6
Grundy	138.4	123.7	144.4	152.0	156.5
Guthrie	102.3	78.5	97.7	86.3	87.4
Hamilton	169.9	131.3	162.9	171.8	175.8
Hancock	158.7	116.1	154.2	170.2	174.6
Hardin	156.6	120.5	158.1	161.0	165.5
Harrison	165.2	119.4	171.8	159.5	162.9
Henry	84.2	77.1	92.2	103.7	108.7
Howard	96.8	60.3	78.8	75.0	77.3
Humboldt	123.9	98.0	122.0	131.7	130.6
Ida	108.6	88.0	121.7	132.4	130.7
Iowa	115.0	87.0	111.3	111.4	112.9
Jackson	83.6	80.9	92.0	114.7	117.1
Jasper	151.5	133.0	156.7	159.7	163.0
Jefferson	68.6	50.3	62.2	72.0	75.1

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Table A-7. continued

County	Estimated			Projections to	
	1959	1969	1974	1984	1989
Johnson	119.0	101.4	113.4	124.9	127.9
Jones	113.6	103.5	120.3	131.4	134.8
Keokuk	106.4	90.4	111.5	120.5	125.0
Kossuth	272.2	208.2	268.5	307.2	305.9
Lee	76.2	81.3	86.2	121.7	130.1
Linn	148.1	127.9	139.0	158.0	162.2
Louisa	82.3	70.0	79.1	97.2	100.1
Lucas	40.3	32.6	35.8	32.3	33.1
Lyon	155.9	126.8	143.2	130.6	131.9
Madison	79.2	61.8	77.0	65.8	66.4
Mahaska	119.5	96.0	114.0	128.5	131.4
Marion	88.0	64.4	76.7	81.1	82.5
Marshall	140.2	121.4	150.5	156.3	160.6
Mills	115.9	78.7	97.2	82.2	82.2
Mitchell	122.0	80.5	102.8	88.6	90.1
Monona	150.7	129.6	169.6	175.4	180.4
Monroe	35.0	21.2	31.9	29.4	30.1
Montgomery	91.7	71.7	90.2	70.3	70.6
Muscatine	93.0	75.7	82.5	96.6	98.1
O'Brien	156.0	129.1	150.9	159.8	163.3
Osceola	111.6	83.9	99.2	98.4	100.0
Page	107.4	84.2	103.1	79.1	79.4
Palo Alto	160.9	112.9	150.5	167.9	166.6
Plymouth	230.5	187.9	237.9	225.1	230.5
Pocahontas	161.5	118.2	156.8	165.1	169.6
Polk	111.2	93.0	110.6	105.7	108.4
Pottawattamie	243.0	181.0	242.2	198.8	202.4
Poweshiek	120.3	91.1	112.9	95.8	96.5
Ringgold	59.0	41.2	51.3	45.4	46.6
Sac	148.3	122.5	158.9	149.5	152.2
Scott	105.1	108.2	106.3	116.6	119.1
Shelby	149.3	117.5	167.1	134.0	127.7
Sioux	222.1	203.9	230.8	206.1	208.9
Story	164.1	120.3	153.4	150.2	154.0
Tama	149.8	131.5	160.1	161.9	165.5
Taylor	69.7	52.4	65.5	45.9	46.5
Union	55.7	40.4	44.2	37.2	37.4
Van Buren	46.0	41.7	47.8	64.8	67.4
Wapello	57.4	43.9	55.0	62.3	65.0
Warren	76.4	58.9	71.9	76.5	78.0
Washington	122.8	104.6	121.7	128.4	132.4
Wayne	57.4	46.7	49.4	51.6	53.2
Webster	182.9	136.0	180.3	186.5	192.3
Winnebago	118.5	76.8	106.3	107.5	110.2
Winneshiek	99.7	89.5	111.0	112.9	117.2
Woodbury	201.7	151.5	227.3	204.3	209.4
Worth	109.9	72.6	109.6	110.1	114.5
Wright	170.2	130.7	164.7	176.6	175.4
Total	12,115.5	9,563.9	11,996.0	12,097.4	12,356.2

Table A-8. Estimated soybean acres in 1959, 1969, and 1974, and projections to 1984 and 1989 in thousands of acres, by counties, Iowa

County	Estimated			Projections to	
	1959	1969	1974	1984	1989
Adair	8.5	43.9	51.6	70.1	76.4
Adams	7.3	30.6	31.6	39.5	41.7
Allamakee	0.3	2.8	4.5	7.2	8.7
Appanoose	23.9	32.0	36.3	47.4	48.0
Audubon	2.1	26.5	40.1	66.5	79.4
Benton	11.3	68.6	106.1	145.0	165.6
Black Hawk	15.0	57.4	87.3	107.0	117.1
Boone	40.0	85.7	110.3	123.6	129.5
Bremer	9.5	39.7	59.4	65.2	71.5
Buchanan	10.9	53.9	79.1	96.6	106.4
Buena Vista	37.7	92.2	113.0	149.6	151.2
Butler	16.0	59.0	88.3	93.5	102.0
Calhoun	73.6	123.7	137.9	143.9	146.7
Carroll	24.0	67.0	83.9	101.4	108.7
Cass	3.9	37.9	55.8	79.3	91.9
Cedar	5.5	41.6	70.4	112.6	132.6
Cerro Gordo	26.7	72.3	102.6	117.2	126.1
Cherokee	28.9	58.5	79.1	102.6	107.0
Chickasaw	16.6	46.3	68.1	62.3	66.0
Clarke	11.4	23.0	27.2	26.2	27.1
Clay	41.1	83.1	108.3	131.0	137.3
Clayton	0.3	2.6	6.5	8.6	10.5
Clinton	6.8	35.8	57.0	95.0	109.8
Crawford	3.3	39.1	57.5	115.9	141.5
Dallas	43.0	79.3	93.6	99.9	102.4
Davis	22.9	27.6	35.9	39.0	40.4
Decatur	14.1	22.3	26.8	27.2	27.8
Delaware	2.4	16.4	30.6	47.7	56.4
Des Moines	21.1	36.0	53.4	60.6	64.0
Dickinson	25.3	51.9	68.9	85.9	91.5
Dubuque	0.1	1.6	3.3	9.2	13.0
Emmet	39.3	67.4	86.6	103.5	104.0
Fayette	18.4	46.9	72.5	72.1	77.1
Floyd	18.7	67.7	92.4	102.6	111.3
Franklin	23.5	76.4	106.1	142.3	157.0
Fremont	17.0	52.5	77.5	95.6	100.1
Greene	64.1	104.8	122.1	130.6	133.6
Grundy	21.3	69.1	91.2	113.6	123.1
Guthrie	18.9	53.3	62.3	72.2	76.1
Hamilton	51.9	108.6	131.0	149.2	155.2
Hancock	44.4	93.4	121.8	153.1	161.3
Hardin	23.6	79.5	101.3	129.2	139.4
Harrison	29.1	61.4	74.6	93.5	98.7
Henry	17.8	44.8	56.0	68.7	74.0
Howard	17.3	45.0	68.0	54.1	57.3
Humboldt	40.1	82.8	102.4	126.2	127.2
Ida	9.4	36.8	48.6	81.4	85.4
Iowa	7.7	29.9	45.3	63.4	71.0
Jackson	0.6	4.9	7.4	15.9	18.5
Jasper	21.0	58.7	82.9	104.5	114.0
Jefferson	24.1	42.9	53.4	59.4	62.3

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Table A-8. continued

County	Estimated			Projections to	
	1959	1969	1974	1984	1989
Johnson	10.5	32.1	57.4	72.2	79.4
Jones	2.1	20.1	37.6	66.3	79.6
Keokuk	25.5	46.3	58.9	62.8	65.4
Kossuth	97.9	182.6	244.9	276.6	277.9
Lee	25.0	34.9	49.0	56.4	60.0
Linn	11.0	51.4	78.6	109.3	122.9
Louisa	23.5	43.7	54.6	62.7	65.9
Lucas	14.1	24.7	25.2	25.0	25.7
Lyon	23.9	47.0	69.3	82.5	87.2
Madison	20.5	45.8	49.1	55.3	57.3
Mahaska	24.6	56.3	71.5	90.6	95.6
Marion	18.3	35.0	45.8	56.3	58.8
Marshall	18.1	59.4	77.9	99.2	107.3
Mills	6.1	46.3	63.7	90.2	95.0
Mitchell	16.8	49.0	81.6	71.8	77.8
Monona	57.7	65.6	77.0	83.2	85.0
Monroe	12.5	16.8	20.7	22.0	22.4
Montgomery	6.4	38.1	55.1	72.8	78.8
Muscatine	19.2	33.0	51.1	60.2	63.8
O'Brien	51.4	88.3	116.0	139.8	145.2
Osceola	36.0	55.1	76.7	86.0	89.9
Page	10.7	50.6	71.4	83.6	87.1
Palo Alto	50.5	103.6	134.5	166.5	167.7
Plymouth	19.3	59.1	75.3	119.0	129.6
Pocahontas	64.2	124.4	146.8	175.2	174.9
Polk	45.6	76.4	85.0	83.0	85.1
Pottawattamie	11.4	71.2	106.6	169.7	195.0
Poweshiek	13.2	49.7	67.4	84.3	92.7
Ringgold	20.0	29.8	37.7	36.5	37.7
Sac	28.0	72.7	85.2	109.6	115.4
Scott	7.7	30.1	43.7	60.4	66.9
Shelby	1.6	37.9	56.7	131.0	137.2
Sioux	29.0	54.9	70.2	90.6	95.1
Story	35.8	89.2	116.8	125.1	131.7
Tama	18.3	61.4	95.0	123.4	136.5
Taylor	18.0	40.1	48.4	45.0	46.7
Union	9.2	21.9	26.0	28.0	29.1
Van Buren	27.5	34.0	37.2	42.1	43.1
Wapello	26.7	39.3	47.0	50.3	52.2
Warren	28.8	43.6	46.3	49.5	49.8
Washington	19.6	53.3	73.2	83.4	89.3
Wayne	22.7	32.6	42.8	39.7	40.7
Webster	86.3	147.8	163.4	187.1	191.8
Winnebago	27.1	66.1	92.7	107.5	114.2
Winneshiek	2.8	12.3	18.4	21.4	24.0
Woodbury	38.7	55.0	64.2	81.6	85.3
Worth	29.9	59.2	79.0	77.2	81.1
Wright	52.6	115.5	139.6	167.6	168.9
Total	2,328.0	5,388.3	7,110.0	8,687.3	9,254.5

Table A-9. Estimated oat acres in 1959, 1969, and 1974, and projections to 1984 and 1989 in thousands of acres, by counties, Iowa

County	Estimated			Projections to	
	1959	1969	1974	1984	1989
Adair	44.7	22.4	19.3	12.1	12.4
Adams	27.6	12.9	11.4	7.1	7.3
Allamakee	34.7	23.9	21.1	13.2	13.9
Appanoose	8.2	6.0	7.2	4.4	4.5
Audubon	41.1	21.7	13.8	14.0	14.3
Benton	73.3	36.1	26.5	16.4	16.5
Black Hawk	47.8	18.5	15.9	8.4	8.4
Boone	53.9	14.7	10.0	6.4	6.4
Bremer	42.0	19.1	18.2	10.9	11.2
Buchanan	55.4	24.1	22.6	12.2	12.6
Buena Vista	59.8	17.0	11.1	4.4	3.8
Butler	54.0	24.2	21.9	11.7	12.0
Calhoun	51.2	10.2	9.9	5.4	5.3
Carroll	59.2	20.2	17.8	11.7	11.7
Cass	46.7	18.6	13.3	10.5	10.4
Cedar	55.8	29.6	20.9	12.4	13.2
Cerro Gordo	46.5	16.9	12.5	6.5	6.4
Cherokee	49.8	19.1	12.3	8.9	8.9
Chickasaw	47.1	23.1	21.5	11.5	12.0
Clarke	17.4	11.3	8.8	6.4	6.6
Clay	51.5	14.9	9.7	5.5	5.3
Clayton	56.7	39.9	35.7	22.7	23.9
Clinton	57.6	31.4	24.9	14.4	15.4
Crawford	77.2	33.1	28.9	22.4	23.3
Dallas	44.0	12.2	8.1	4.0	3.9
Davis	10.5	8.5	8.1	5.3	5.6
Decatur	13.3	7.2	7.1	4.2	4.3
Delaware	56.1	37.8	36.6	21.0	24.3
Des Moines	18.4	5.9	6.5	3.2	3.2
Dickinson	33.4	11.0	6.6	4.8	4.8
Dubuque	50.4	38.2	39.7	24.2	25.6
Emmet	30.9	7.8	4.9	2.7	2.6
Fayette	59.6	31.9	32.1	19.0	19.9
Floyd	46.5	16.2	13.3	7.1	7.1
Franklin	52.0	16.8	11.6	7.4	7.2
Fremont	12.0	1.0	2.4	0.6	0.6
Greene	49.4	10.2	6.9	3.6	3.5
Grundy	48.4	17.4	12.8	7.4	7.3
Guthrie	41.4	17.5	12.8	7.1	7.1
Hamilton	56.5	11.0	8.2	4.3	4.2
Hancock	49.4	16.9	14.3	9.2	4.6
Hardin	53.5	12.9	9.2	5.1	4.9
Harrison	39.0	11.8	11.1	9.1	9.5
Henry	25.7	8.8	9.9	5.1	5.1
Howard	45.2	24.9	21.9	12.7	13.3
Humboldt	38.3	9.1	6.6	1.3	1.3
Ida	48.5	18.8	13.7	12.2	12.4
Iowa	41.9	29.5	21.2	11.4	11.7
Jackson	37.3	27.6	27.7	17.5	18.3
Jasper	60.9	30.2	22.7	12.8	13.1
Jefferson	23.8	11.6	12.1	7.7	8.0

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Table A-9. continued

County	Estimated			Projections to	
	1959	1969	1974	1984	1989
Johnson	44.2	24.5	21.0	10.4	10.6
Jones	42.1	27.1	22.9	13.0	13.3
Keokuk	37.1	18.6	15.7	10.1	10.3
Kossuth	85.7	23.1	16.7	6.2	6.2
Lee	11.3	5.0	5.5	2.9	2.8
Linn	57.2	28.4	19.6	13.0	13.0
Louisa	23.1	7.2	5.1	3.2	3.1
Lucas	12.3	9.4	9.1	4.6	4.8
Lyon	68.5	35.9	28.1	20.4	21.1
Madison	28.6	12.7	12.3	7.6	7.6
Mahaska	44.1	19.7	19.1	12.4	12.8
Marion	30.3	13.5	13.8	9.4	9.6
Marshall	52.0	16.2	13.4	6.9	6.8
Mills	22.8	3.7	4.4	1.9	1.8
Mitchell	49.8	24.4	18.8	10.8	10.9
Monona	28.6	12.0	10.1	6.7	7.0
Monroe	10.7	4.0	8.3	3.8	4.0
Montgomery	29.6	7.5	7.7	3.7	3.6
Muscatine	28.4	13.7	11.3	5.2	5.3
O'Brien	49.9	24.0	12.2	10.3	10.6
Osceola	33.9	19.9	11.9	9.3	9.5
Page	28.4	7.0	8.2	4.3	4.3
Palo Alto	56.4	13.5	10.2	5.5	5.5
Plymouth	99.8	49.9	42.9	30.0	31.0
Pocahontas	57.9	11.6	6.8	4.4	2.1
Polk	32.2	8.8	6.7	3.8	3.8
Pottawattamie	77.0	25.4	12.5	13.3	13.1
Poweshiek	49.9	27.1	23.0	12.3	12.7
Ringgold	18.8	10.2	10.4	6.1	6.6
Sac	59.0	17.8	16.2	10.6	10.7
Scott	35.0	17.6	13.4	7.8	7.8
Shelby	68.3	31.1	23.8	29.4	29.4
Sioux	89.8	41.9	32.2	23.9	24.4
Story	52.6	10.1	6.9	3.1	3.1
Tama	61.9	29.0	21.8	11.9	11.9
Taylor	25.3	12.2	13.3	7.2	7.5
Union	22.2	11.3	11.3	6.5	6.7
Van Buren	8.9	7.4	9.8	5.3	5.7
Wapello	15.6	8.1	6.5	5.2	5.4
Warren	26.9	10.0	10.8	6.8	6.9
Washington	42.4	18.1	14.4	8.8	8.8
Wayne	20.4	13.5	10.8	8.8	10.4
Webster	59.0	10.7	7.2	4.6	4.4
Winnebago	32.5	12.1	7.9	5.0	5.0
Winneshiek	61.1	44.0	41.4	25.2	26.4
Woodbury	61.5	29.0	24.6	21.0	22.2
Worth	34.3	15.0	9.6	6.8	6.8
Wright	51.5	12.1	7.1	3.1	3.0
Total	4,284.3	1,816.6	1,500.0	942.0	959.4

Table A-10. Comparison of estimated row crop land available under maximum soil conservation methods, estimated 1974 row crop acres harvested, and projected row crop acres for 1984 and 1989 in thousand of acres, by counties, Iowa

County	Est. Max Row Crop Acres Available	Est. Row Crop Acres Harvested 1974	Projected Row Crop Acres 1984	1989
Adair	284.2	153.4	154.6	161.9
Adams	220.9	97.2	92.4	95.1
Allamakee	242.1	84.3	84.6	88.8
Appanoose	203.2	74.0	94.5	95.9
Audubon	210.8	158.5	160.3	175.3
Benton	397.0	282.9	314.7	338.4
Black Hawk	321.2	230.6	254.6	267.8
Boone	333.1	259.2	283.0	294.3
Bremer	267.2	169.6	171.8	181.4
Buchanan	344.2	226.5	262.5	278.6
Buena Vista	332.7	283.0	332.7	332.7
Butler	348.6	240.2	239.1	251.2
Calhoun	352.2	294.4	291.0	297.1
Carroll	317.0	258.9	257.8	268.4
Cass	296.9	194.6	187.4	201.9
Cedar	318.1	216.1	266.1	289.1
Cerro Gordo	329.4	259.8	269.0	281.6
Cherokee	316.4	245.3	270.4	277.9
Chickasaw	308.3	184.6	169.2	175.6
Clarke	182.0	67.1	56.6	57.9
Clay	346.0	257.8	275.8	284.9
Clayton	299.5	141.6	161.7	171.4
Clinton	346.2	245.8	296.7	314.7
Crawford	345.9	243.9	272.5	303.0
Dallas	318.6	243.0	247.7	254.5
Davis	246.3	86.1	96.3	100.1
Decatur	213.2	72.0	70.1	72.2
Delaware	313.6	181.6	215.8	230.8
Des Moines	198.3	139.4	164.5	171.3
Dickinson	216.5	167.6	184.6	192.6
Dubuque	218.3	120.3	130.2	137.6
Emmet	224.5	194.4	224.5	224.5
Fayette	381.3	243.1	251.6	264.3
Floyd	304.8	219.6	220.5	231.2
Franklin	351.2	268.5	314.4	333.6
Fremont	277.3	200.6	206.8	211.8
Greene	334.3	286.3	291.6	298.0
Grundy	304.8	240.1	270.3	284.2
Guthrie	290.2	167.5	161.9	166.9
Hamilton	341.5	296.9	323.1	333.2
Hancock	340.1	281.1	327.5	340.1
Hardin	335.9	263.6	295.2	310.2
Harrison	298.4	257.5	259.0	267.9
Henry	234.5	150.4	173.5	183.7
Howard	288.6	162.6	136.9	142.5
Humboldt	261.3	227.7	261.3	261.3
Ida	225.2	180.0	222.7	225.2
Iowa	269.7	165.0	180.0	189.0
Jackson	212.8	111.9	140.8	145.8
Jasper	377.3	249.2	270.2	283.0
Jefferson	215.5	122.6	133.1	139.1

(cont. on next page)

Table A-10. continued

County	Est. Max. Row Crop Acres Available	Est. Row Crop Acres Harvested 1974	Projected Row Crop Acres 1984	Projected Row Crop Acres 1989
Johnson	263.2	175.2	200.2	210.3
Jones	282.0	169.9	205.8	222.5
Keokuk	306.8	174.4	185.6	192.8
Kossuth	591.8	521.1	591.8	591.8
Lee	258.2	140.6	181.7	193.8
Linn	361.4	225.8	272.6	290.3
Louisa	196.6	135.2	160.9	167.0
Lucas	210.6	68.1	61.0	62.7
Lyon	343.1	248.0	231.9	238.7
Madison	259.4	132.8	124.5	127.1
Mahaska	310.8	194.4	225.9	234.0
Marion	256.3	129.4	140.8	144.7
Marshall	317.5	233.7	259.8	272.1
Mills	201.1	171.0	180.4	185.4
Mitchell	283.6	201.6	169.5	176.8
Monona	311.3	256.5	264.6	271.6
Monroe	183.4	59.1	54.8	56.1
Montgomery	225.9	156.2	148.6	155.1
Muscatine	241.0	138.9	160.4	165.4
O'Brien	346.0	281.4	312.4	321.7
Osceola	240.0	191.2	193.9	199.7
Page	289.9	182.7	165.6	169.3
Palo Alto	340.4	290.6	340.4	340.4
Plymouth	451.6	341.8	359.6	375.9
Pocahontas	351.8	308.4	345.3	349.5
Polk	293.2	197.8	190.2	195.0
Pottawattamie	460.3	378.8	381.3	410.6
Poweshiek	297.1	185.1	183.0	192.1
Ringgold	256.1	99.3	85.0	87.4
Sac	336.2	261.3	274.4	283.6
Scott	219.8	158.8	182.2	191.2
Shelby	277.5	240.4	277.5	277.5
Sioux	444.0	353.9	335.2	345.1
Story	321.9	274.9	279.1	289.5
Tama	368.2	260.6	290.0	306.7
Taylor	295.2	122.2	93.1	95.5
Union	209.6	78.4	67.6	68.8
Van Buren	187.9	87.8	108.7	112.6
Wapello	210.2	103.9	113.9	118.6
Warren	281.6	125.6	129.2	131.1
Washington	315.1	199.2	214.0	224.0
Wayne	257.1	97.9	94.4	97.2
Webster	417.7	345.4	375.1	385.6
Winnebago	237.5	201.3	217.0	226.4
Winneshiek	322.5	148.6	148.7	155.7
Woodbury	417.8	314.5	299.1	308.4
Worth	240.6	191.6	189.3	197.5
Wright	346.6	307.0	346.6	346.6
Total	29,294.5	20,030.0	21,404.8	22,240.5

Table A-11. Estimated 1959, 1969, and 1974 corn yields, and 1984 and 1989 projected corn yields in bushels per acre, by counties, Iowa

County	Estimated			Projections to	
	1959	1969	1974	1984	1989
Adair	62.6	87.9	57.3	117.8	125.0
Adams	59.1	84.3	42.5	119.3	126.7
Allamakee	66.3	97.7	87.9	117.4	124.9
Appanoose	53.1	80.6	68.6	81.1	86.1
Audubon	66.1	97.6	61.0	117.6	123.0
Benton	77.1	102.0	99.0	133.4	140.8
Black Hawk	72.7	87.9	97.0	116.3	123.4
Boone	69.8	104.6	99.9	126.6	134.1
Bremer	68.7	88.9	95.3	120.6	127.6
Buchanan	66.7	93.0	97.9	114.9	121.9
Buena Vista	69.1	101.7	92.2	108.0	114.4
Butler	67.5	80.9	85.0	122.7	130.0
Calhoun	65.4	99.1	97.8	123.1	130.4
Carroll	64.5	96.8	79.6	120.4	127.4
Cass	64.7	93.0	50.8	121.9	128.7
Cedar	76.2	110.1	95.5	131.2	138.7
Cerro Gordo	64.5	97.1	87.8	119.8	126.9
Cherokee	62.9	104.4	84.3	103.0	109.1
Chickasaw	57.6	81.9	74.9	112.1	119.2
Clarke	48.9	64.3	52.1	116.7	123.6
Clay	60.9	106.9	71.0	113.0	119.7
Clayton	31.2	93.3	92.6	118.0	125.4
Clinton	75.1	110.3	76.0	116.2	123.1
Crawford	65.0	96.5	62.5	110.3	115.0
Dallas	66.4	102.0	82.5	122.1	129.5
Davis	51.6	76.0	76.6	98.8	104.7
Decatur	39.5	70.7	60.5	108.4	114.5
Delaware	64.8	91.5	90.7	115.6	122.6
Des Moines	76.6	100.8	100.1	116.2	123.3
Dickinson	40.3	102.5	60.2	104.4	110.6
Dubuque	68.2	92.0	84.8	117.4	124.1
Emmet	53.4	106.2	89.8	107.9	114.4
Fayette	61.7	90.2	93.7	115.5	122.6
Floyd	63.4	94.4	71.3	116.6	123.4
Franklin	73.3	102.4	99.4	124.2	130.8
Fremont	58.2	98.6	50.7	105.9	112.3
Greene	63.3	104.6	89.0	123.2	130.6
Grundy	82.6	97.4	106.4	135.1	143.0
Guthrie	63.3	91.0	62.0	119.3	126.4
Hamilton	73.3	95.8	95.3	123.9	131.2
Hancock	63.5	106.7	91.4	117.9	124.2
Hardin	77.6	102.1	104.3	129.5	137.1
Harrison	61.1	106.3	52.4	106.6	112.5
Henry	66.8	97.5	98.0	126.3	133.3
Howard	55.6	81.2	52.7	108.1	114.7
Humboldt	69.1	108.0	95.3	117.9	124.9
Ida	63.8	103.1	82.1	98.1	103.9
Iowa	66.3	92.0	78.6	117.0	124.5
Jackson	68.3	95.9	67.9	96.1	102.1
Jasper	67.1	101.1	84.8	125.9	133.7
Jefferson	60.3	90.2	83.0	116.9	123.4

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Table A-11. continued

County	Estimated			Projections to	
	1959	1969	1974	1984	1989
Johnson	65.7	98.7	86.4	119.0	126.3
Jones	71.8	96.4	87.0	119.6	126.3
Keokuk	63.2	87.0	91.8	120.5	127.6
Kossuth	62.4	113.2	98.9	114.2	121.1
Lee	65.5	88.9	88.3	108.3	113.9
Linn	66.5	92.3	90.0	117.3	123.7
Louisa	67.2	101.0	98.2	118.5	125.8
Lucas	47.0	76.5	55.2	121.9	129.3
Lyon	48.0	103.6	47.4	104.8	111.0
Madison	64.6	86.6	60.8	120.2	127.3
Mahaska	63.2	86.9	90.1	113.5	120.7
Marion	56.7	81.2	76.9	115.1	122.0
Marshall	75.6	108.9	104.3	130.9	139.1
Mills	61.7	103.1	51.7	112.6	119.3
Mitchell	63.0	93.1	60.4	126.2	133.8
Monona	58.0	99.8	57.0	99.2	105.4
Monroe	47.6	67.2	60.0	103.2	109.3
Montgomery	56.8	96.1	55.8	124.2	131.4
Muscatine	68.4	101.9	87.7	114.9	122.4
O'Brien	60.5	116.9	77.3	108.2	114.6
Osceola	52.0	111.3	52.6	109.1	115.7
Page	56.8	90.7	44.1	120.2	127.4
Palo Alto	59.8	103.8	93.0	108.6	115.1
Plymouth	55.7	89.4	61.9	101.5	107.4
Pocahontas	66.5	106.8	98.1	115.8	122.6
Polk	65.3	100.6	75.0	130.2	137.9
Pottawattamie	64.4	104.8	43.7	113.4	118.6
Poweshiek	62.9	90.8	80.3	132.1	140.0
Ringgold	48.0	69.6	39.1	113.5	120.3
Sac	65.6	98.9	86.5	112.8	119.3
Scott	72.7	108.3	82.4	128.2	135.9
Shelby	70.7	99.5	63.2	108.6	115.1
Sioux	55.0	101.0	69.6	104.5	110.4
Story	75.1	104.1	99.9	129.9	137.5
Tama	73.1	98.2	99.8	131.7	139.8
Taylor	50.3	79.2	32.5	124.4	131.9
Union	53.5	78.0	44.5	119.1	126.2
Van Buren	61.2	82.7	79.4	96.8	102.7
Wapello	63.0	86.6	91.9	117.9	124.7
Warren	56.4	74.6	70.1	112.5	119.3
Washington	66.1	99.7	85.2	128.5	135.9
Wayne	47.8	75.6	69.4	114.9	121.8
Webster	66.8	96.2	101.8	122.0	129.0
Winnebago	64.8	108.8	82.3	118.7	125.6
Winneshiek	62.1	87.8	81.7	109.9	116.8
Woodbury	57.9	93.8	62.8	97.4	102.8
Worth	62.0	97.9	82.8	116.1	122.9
Wright	69.3	103.8	97.0	119.5	126.6
State	63.7	97.6	80.0	116.3	123.1

Table A-12. Estimated 1959, 1969, and 1974 soybean yields, and 1984 and 1989 projected soybean yields in bushels per acre, by counties, Iowa

County	Estimated			Projections to	
	1959	1969	1974	1984	1989
Adair	27.3	30.7	26.5	41.2	43.7
Adams	25.9	29.6	25.2	41.8	44.4
Allamakee	22.9	28.5	25.6	41.1	43.7
Appanoose	21.5	27.7	18.3	28.4	30.1
Audubon	25.1	31.7	27.2	41.1	43.1
Benton	29.4	37.7	34.4	46.7	49.3
Black Hawk	27.3	30.2	31.9	40.7	43.2
Boone	28.9	31.7	30.3	44.3	46.9
Bremer	24.9	28.7	29.0	42.2	44.7
Buchanan	24.3	29.8	30.8	40.2	42.7
Buena Vista	30.3	30.0	32.2	37.8	40.0
Butler	26.3	27.5	27.0	42.9	45.5
Calhoun	28.2	28.9	30.6	43.1	45.6
Carroll	23.7	29.9	30.9	42.2	44.6
Cass	27.9	32.5	28.3	42.7	45.1
Cedar	30.6	40.2	31.6	45.9	48.6
Cerro Gordo	24.6	30.6	28.0	41.9	44.4
Cherokee	29.0	35.9	30.5	36.0	38.2
Chickasaw	20.7	24.0	23.2	39.2	41.7
Clarke	22.4	24.5	20.1	40.9	43.3
Clay	27.4	34.8	27.3	39.6	41.9
Clayton	25.2	28.4	28.0	41.3	43.9
Clinton	25.5	38.2	28.0	40.7	43.1
Crawford	25.7	33.0	29.7	38.6	40.3
Dallas	28.6	33.9	28.2	42.8	45.3
Davis	21.5	28.6	19.4	34.6	36.7
Decatur	17.1	27.3	20.6	37.9	40.1
Delaware	23.8	28.4	28.7	40.5	42.9
Des Moines	28.5	37.2	26.0	40.7	43.1
Dickinson	19.9	31.3	26.1	36.6	38.7
Dubuque	23.0	32.3	26.4	41.1	43.4
Emmet	24.3	32.0	30.8	37.8	40.0
Fayette	24.1	27.4	29.0	40.4	42.9
Floyd	23.7	28.9	24.7	40.8	43.2
Franklin	29.1	34.4	32.0	43.5	45.8
Fremont	28.1	37.4	29.5	37.1	39.3
Greene	24.8	32.4	29.8	43.1	45.7
Grundy	32.1	34.6	34.8	47.3	50.0
Guthrie	26.0	29.3	25.6	41.8	44.3
Hamilton	29.9	31.1	26.7	43.4	45.9
Hancock	25.7	32.6	30.0	41.3	43.5
Hardin	31.1	35.0	29.8	45.3	48.0
Harrison	20.0	35.1	27.8	37.3	39.4
Henry	28.0	35.5	28.8	44.2	46.7
Howard	20.8	22.0	18.6	37.8	40.2
Humboldt	30.3	34.9	32.2	41.3	43.7
Ida	26.9	34.2	29.9	34.4	36.4
Iowa	24.9	32.0	24.5	41.0	43.6
Jackson	27.1	31.8	23.4	33.6	35.7
Jasper	25.4	36.4	25.5	44.1	46.8
Jefferson	26.8	31.5	25.4	40.9	43.2

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Table A-12. continued

County	Estimated			Projections to	
	1959	1969	1974	1984	1989
Johnson	27.7	35.9	27.5	41.7	44.2
Jones	28.1	35.2	29.0	41.9	44.2
Keokuk	27.6	30.2	25.4	42.2	44.7
Kossuth	26.8	34.0	31.2	40.0	42.4
Lee	24.9	30.0	22.9	37.9	39.9
Linn	26.3	33.6	29.2	41.0	43.3
Louisa	25.7	34.4	26.2	41.5	44.0
Lucas	21.3	24.4	19.1	42.7	45.3
Lyon	22.4	33.4	26.6	36.7	38.9
Madison	27.6	33.6	21.1	42.1	44.6
Mahaska	26.8	33.5	25.8	39.7	42.2
Marion	24.2	30.4	21.8	40.3	42.7
Marshall	29.6	37.3	29.7	45.8	48.7
Mills	29.2	38.1	30.1	39.4	41.5
Mitchell	23.1	27.4	22.3	44.2	46.8
Monona	20.1	31.8	22.1	34.7	36.9
Monroe	22.2	23.0	17.2	36.1	38.3
Montgomery	26.1	36.5	29.5	43.5	45.9
Muscatine	24.0	35.2	28.4	40.2	42.8
O'Brien	28.2	37.5	27.9	37.9	40.1
Osceola	22.8	33.4	23.4	38.2	40.5
Page	27.4	35.9	27.6	42.0	44.5
Palo Alto	27.5	32.1	30.1	38.0	40.3
Plymouth	25.4	30.9	32.5	35.5	37.6
Pocahontas	29.2	33.2	30.8	40.5	42.9
Polk	25.4	32.3	23.0	45.6	48.3
Pottawattamie	25.8	37.6	29.7	39.7	41.5
Poweshiek	27.5	34.9	27.3	46.3	49.0
Ringgold	21.1	24.8	20.5	39.7	42.1
Sac	27.7	30.9	31.3	39.5	41.8
Scott	27.1	39.6	27.5	44.9	47.6
Shelby	27.9	30.7	31.1	38.0	40.3
Sioux	25.8	34.3	32.3	36.6	38.6
Story	29.1	33.7	25.4	45.5	48.1
Tama	27.1	35.9	32.1	46.1	48.9
Taylor	23.4	27.9	21.7	43.6	46.2
Union	23.6	28.9	22.0	41.7	44.2
Van Buren	25.0	27.9	22.4	33.9	35.9
Wapello	26.2	30.3	25.1	41.3	43.6
Warren	23.0	26.8	21.1	39.4	41.8
Washington	29.8	36.1	24.8	45.0	47.6
Wayne	21.3	27.3	19.6	40.2	42.6
Webster	28.9	29.8	30.2	42.7	45.2
Winnebago	26.2	31.4	25.9	41.5	43.9
Winneshiek	21.3	25.7	22.9	38.5	40.9
Woodbury	19.5	31.2	27.7	34.1	36.0
Worth	23.4	29.0	24.5	40.6	43.0
Wright	29.4	33.9	31.2	41.8	44.3
State	26.1	32.3	28.0	40.9	43.4

Table A-13. Projected tons of fertilizer to be applied in 1984, by type of fertilizer and counties, Iowa

County	Diammonium Phosphate	Muriate of Potash	Anhydrous Ammonia	Urea	Nitrogen Solutions
Adair	8,048.6	5,418.4	5,100.3	1,904.2	3,938.7
Adams	5,857.4	3,739.6	2,905.8	1,084.9	2,244.0
Allamakee	6,413.3	6,007.4	2,630.9	982.3	2,031.7
Appanoose	6,666.0	4,567.3	2,098.2	783.4	1,620.3
Audubon	10,272.9	6,539.7	4,749.4	1,773.2	3,667.8
Benton	22,927.6	17,411.5	6,729.8	2,512.6	5,197.1
Black Hawk	17,261.6	16,327.1	5,669.4	2,116.7	4,378.2
Boone	18,396.6	14,334.6	8,791.7	3,282.4	6,789.4
Bremer	12,005.6	11,512.6	4,297.1	1,604.3	3,318.4
Buchanan	21,283.9	20,401.7	7,104.9	2,652.7	5,486.8
Buena Vista	21,008.7	14,163.0	8,147.8	3,042.0	6,292.1
Butler	18,817.9	15,478.9	7,130.5	2,662.2	5,506.5
Calhoun	18,200.0	15,573.7	8,167.7	3,049.5	6,307.5
Carroll	19,561.6	11,061.2	5,901.4	2,203.3	4,557.4
Cass	9,185.4	5,691.7	6,315.3	2,357.8	4,877.0
Cedar	18,225.1	15,043.9	6,073.1	2,267.4	4,690.0
Cerro Gordo	22,184.8	20,476.2	6,903.8	2,577.6	5,331.5
Cherokee	17,904.2	8,398.6	6,267.3	2,340.0	4,840.0
Chickasaw	14,387.4	13,628.3	4,953.6	1,849.5	3,825.4
Clarke	3,750.5	3,065.9	1,517.3	566.5	1,171.7
Clay	17,696.5	12,165.0	6,405.4	2,391.5	4,946.6
Clayton	13,481.8	12,594.4	5,633.8	2,103.4	4,350.7
Clinton	24,722.9	18,227.2	7,877.7	2,941.2	6,083.6
Crawford	20,878.1	12,052.6	5,932.2	2,214.8	4,581.1
Dallas	16,159.9	12,613.7	8,337.2	3,112.7	6,438.4
Davis	7,400.9	5,870.4	3,259.2	1,216.8	2,516.9
Decatur	4,519.7	3,614.9	2,115.0	789.7	1,633.3
Delaware	19,854.9	16,068.0	5,218.9	1,948.5	4,030.3
Des Moines	12,845.3	10,420.6	4,481.8	1,673.3	3,461.1
Dickinson	12,498.4	8,997.7	3,579.3	1,336.4	2,764.1
Dubuque	13,065.3	11,224.7	4,390.5	1,639.2	3,390.6
Emmet	15,013.6	10,599.3	4,317.4	1,611.9	3,334.1
Fayette	18,300.9	18.229.9	6,154.7	2,297.9	4,753.0
Floyd	17,789.0	16,488.9	5,007.6	1,869.6	3,867.1
Franklin	26,031.1	24,090.4	7,718.4	2,881.7	5,960.5
Fremont	9,025.8	5,293.4	6,635.4	2,477.4	5,124.2
Greene	18,243.2	15,544.7	9,170.2	3,423.8	7,081.7
Grundy	22,353.9	18,545.3	8,568.6	3,199.1	6,617.1
Guthrie	8,784.7	6,785.0	4,629.9	1,728.6	3,575.4
Hamilton	27,447.0	22,097.2	8,254.6	3,081.9	6,374.6
Hancock	21,676.3	21,077.5	8,409.6	3,139.8	6,494.3
Hardin	24,157.8	19,956.7	8,942.2	3,338.6	6,905.6
Harrison	17,559.6	8,023.5	8,861.2	3,308.4	6,843.1
Henry	13,616.5	9,906.6	6,663.1	2,487.7	5,145.6
Howard	12,153.5	10,960.1	3,476.4	1,297.9	2,684.7
Humboldt	19,629.9	16,990.2	6,892.2	2,573.2	5,322.5
Ida	16,859.8	6,992.2	6,296.6	2,350.9	4,862.6
Iowa	11,787.2	9,329.3	5,789.2	2,161.4	4,470.7
Jackson	12,833.1	10,266.8	5,826.6	2,175.4	4,499.6
Jasper	16,457.0	12,453.2	7,125.0	2,660.2	5,502.3
Jefferson	10,756.9	8,150.7	4,726.7	1,764.7	3,650.2

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Table A-13. continued

County	Diammonium Phosphate	Muriate of Potash	Anhydrous Ammonia	Urea	Nitrogen Solutions
Johnson	13,821.8	11,477.1	5,363.1	2,002.4	4,141.7
Jones	17,583.3	14,065.5	6,299.9	2,352.1	4,865.1
Keokuk	11,827.4	9,060.7	5,993.1	2,237.6	4,628.2
Kossuth	44,404.5	38,431.4	16,291.1	6,082.4	12,580.8
Lee	14,843.3	10,250.6	6,218.4	2,321.7	4,802.2
Linn	19,965.5	16,221.8	6,563.4	2,450.5	5,068.6
Louisa	9,929.1	9,751.7	5,854.7	2,185.9	4,521.3
Lucas	5,230.6	3,959.2	2,242.0	837.1	1,731.4
Lyon	11,091.0	6,034.3	3,227.5	1,205.0	2,492.4
Madison	7,209.7	5,228.7	3,840.2	1,433.8	2,965.6
Mahaska	14,139.3	10,836.2	6,390.5	2,385.9	4,935.0
Marion	7,091.9	4,955.4	3,561.4	1,329.7	2,750.3
Marshall	15,422.2	11,300.2	6,741.0	2,516.8	5,205.7
Mills	7,901.8	4,481.6	4,296.7	1,604.2	3,318.1
Mitchell	14,008.9	13,153.7	4,344.0	1,621.9	3,354.6
Monona	16,563.8	6,535.7	9,498.1	3,546.2	7,334.9
Monroe	4,189.1	3,080.6	1,591.5	594.2	1,229.0
Montgomery	8,312.7	5,071.3	4,076.0	1,521.8	3,147.7
Muscatine	10,813.7	8,860.0	4,088.2	1,526.3	3,157.1
O'Brien	18,049.4	9,199.5	5,177.0	1,932.9	3,997.9
Osceola	13,224.8	7,204.6	3,684.0	1,375.4	2,845.0
Page	9,137.5	5,668.9	4,811.5	1,796.4	3,715.7
Palo Alto	18,773.6	15,793.3	6,913.5	2,581.2	5,338.9
Plymouth	21,728.4	8,174.3	7,401.4	2,763.3	5,715.7
Pocahontas	21,662.0	16,328.5	7,033.1	2,625.8	5,431.3
Polk	13,196.3	11,205.5	5,425.7	2,025.7	4,190.0
Pottawattamie	23,204.2	13,556.5	10,348.4	3,863.6	7,991.6
Poweshiek	9,841.6	7,314.3	2,882.5	1,076.2	2,226.0
Ringgold	5,490.3	4,388.9	2,372.9	885.9	1,832.5
Sac	22,092.3	14,206.2	7,644.1	2,854.0	5,903.2
Scott	12,475.7	9,485.8	4,807.4	1,794.9	3,712.5
Shelby	17,039.2	10,410.2	7,002.0	2,614.2	5,407.3
Sioux	17,423.8	8,926.9	6,833.7	2,551.4	5,277.3
Story	19,170.5	16,197.4	7,665.2	2,861.8	5,919.4
Tama	17,503.7	13,125.6	6,941.8	2,591.8	5,360.8
Taylor	6,239.2	4,273.0	2,724.4	1,017.2	2,104.0
Union	4,575.0	3,164.6	2,290.3	855.1	1,768.7
Van Buren	9,307.2	6,847.0	3,385.1	1,263.8	2,614.1
Wapello	7,382.2	5,817.8	3,044.5	1,136.7	2,351.1
Warren	7,443.4	5,349.9	4,504.3	1,681.7	3,478.4
Washington	12,496.8	9,255.1	6,950.4	2,595.0	5,367.5
Wayne	7,783.2	5,671.0	3,304.9	1,233.9	2,552.2
Webster	22,442.8	19,280.3	4,543.1	1,696.2	3,508.4
Winnebago	16,360.9	14,214.0	5,538.6	2,067.9	4,277.2
Winneshiek	12,058.7	12,612.8	5,051.9	1,886.2	3,901.3
Woodbury	24,612.9	8,608.2	8,981.6	3,353.3	6,936.0
Worth	14,999.5	14,983.2	5,033.2	1,879.2	3,886.9
Wright	24,763.3	21,185.6	10,781.0	4,025.1	8,325.6
Total	1,480,771.0	1,119,671.0	571,708.2	213,449.3	441,500.6

Table A-14. Projected tons of fertilizer to be applied in 1989, by type of fertilizer and counties, Iowa

County	Diammonium Phosphate	Muriate of Potash	Anhydrous Ammonia	Urea	Nitrogen Solutions
Adair	9,483.5	6,813.7	5,347.3	2,327.3	4,638.9
Adams	6,712.4	4,589.5	3,068.9	1,335.7	2,662.4
Allamakee	8,084.6	7,818.6	3,005.2	1,307.9	2,607.1
Appanoose	7,619.5	5,604.3	2,344.0	1,020.2	2,033.5
Audubon	12,003.3	7,966.0	4,934.2	2,147.5	4,280.6
Benton	25,953.3	20,043.6	6,911.6	3,008.1	5,996.0
Black Hawk	19,084.7	18,069.7	5,897.1	2,566.6	5,115.9
Boone	20,061.2	15,731.4	9,275.8	4,037.1	8,047.0
Bremer	13,494.8	12,975.9	4,556.6	1,983.2	3,953.0
Buchanan	23,652.4	22,664.5	7,566.4	3,293.1	6,564.0
Buena Vista	21,933.3	14,996.8	8,287.1	3,606.7	7,189.3
Butler	20,766.8	17,225.5	7,473.2	3,252.5	6,483.2
Calhoun	19,476.8	16,732.1	8,541.9	3,717.6	7,410.3
Carroll	21,343.1	12,504.3	6,172.6	2,686.5	5,354.9
Cass	10,792.6	7,061.4	6,538.6	2,845.8	5,672.4
Cedar	20,937.4	17,488.8	6,232.0	2,712.3	5,406.5
Cerro Gordo	24,081.2	22,218.7	7,220.4	3,142.5	6,263.9
Cherokee	19,274.2	9,484.2	6,555.7	2,853.2	5,687.2
Chickasaw	15,809.9	15,063.9	5,272.2	2,294.6	4,573.8
Clarke	4,565.5	3,964.5	1,692.9	736.8	1,468.6
Clay	19,162.5	13,433.8	6,675.3	2,905.3	5,791.0
Clayton	15,973.3	15,095.4	6,277.3	2,732.1	5,445.8
Clinton	27,474.7	20,563.2	8,158.9	3,551.0	7,078.1
Crawford	24,307.3	14,555.1	6,152.1	2,677.6	5,337.1
Dallas	17,456.4	13,709.9	8,784.0	3,823.0	7,620.3
Davis	8,701.2	7,216.1	3,656.4	1,591.3	3,172.0
Decatur	5,483.4	4,651.9	2,373.4	1,033.0	2,059.0
Delaware	22,589.0	18,556.8	5,647.3	2,457.9	4,899.2
Des Moines	13,936.5	11,342.5	4,752.4	2,068.4	4,122.8
Dickinson	13,631.5	9,988.0	3,758.1	1,635.6	3,260.3
Dubuque	15,277.2	13,455.9	4,830.4	2,102.3	4,190.5
Emmet	15,621.4	11,166.7	4,418.6	1,923.1	3,833.3
Fayette	20,699.9	20,643.0	6,698.6	2,915.4	5,811.2
Floyd	19,418.5	18,042.7	5,200.9	2,263.6	4,511.9
Franklin	28,642.6	26,531.2	8,040.4	3,499.4	6,975.3
Fremont	9,839.8	5,984.1	6,765.1	2,944.3	5,868.9
Greene	19,544.0	16,700.1	9,556.5	4,159.2	8,290.5
Grundy	24,504.9	20,422.8	8,970.8	3,904.3	7,782.4
Guthrie	9,876.4	7,840.7	4,827.0	2,100.8	4,187.6
Hamilton	29,259.3	23,631.6	8,656.9	3,767.7	7,510.1
Hancock	23,460.7	22,731.7	8,792.7	3,826.8	7,627.9
Hardin	26,350.3	21,849.3	9,355.2	4,071.6	8,115.9
Harrison	19,002.2	9,072.1	9,260.4	4,030.4	8,033.7
Henry	15,112.0	11,120.5	7,144.6	3,109.5	6,198.2
Howard	13,460.0	12,284.4	3,752.4	1,633.1	3,255.3
Humboldt	20,365.2	17,663.9	7,001.4	3,047.2	6,073.9
Ida	17,794.6	7,816.1	6,391.1	2,781.6	5,544.4
Iowa	13,463.4	10,931.4	6,045.4	2,631.1	5,244.5
Jackson	14,618.0	12,074.1	6,271.9	2,729.7	5,441.0
Jasper	18,557.1	14,356.4	7,451.4	3,243.0	6,464.3
Jefferson	11,978.0	9,276.2	5,112.2	2,225.0	4,435.0

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Table A-14. continued

County	Diammonium Phosphate	Muriate of Potash	Anhydrous Ammonia	Urea	Nitrogen Solutions
Johnson	15,473.1	12,995.5	5,632.4	2,451.4	4,886.3
Jones	20,052.2	16,261.5	6,579.0	2,863.3	5,707.4
Keokuk	13,212.8	10,297.2	6,410.1	2,789.9	5,561.0
Kossuth	46,060.8	39,939.8	16,635.7	7,240.3	14,432.0
Lee	16,581.2	11,610.7	6,858.8	2,985.1	5,950.2
Linn	22,363.3	18,358.4	6,859.0	2,985.2	5,950.3
Louisa	10,847.1	10,595.6	6,144.1	2,674.1	5,330.2
Lucas	6,138.5	4,924.7	2,487.3	1,082.6	2,157.8
Lyon	12,442.7	7,322.2	3,395.1	1,477.6	2,945.4
Madison	8,183.6	6,219.7	4,037.8	1,757.3	3,502.9
Mahaska	15,631.7	12,212.7	6,719.1	2,924.3	5,829.0
Marion	8,088.6	5,923.7	3,756.1	1,634.7	3,258.5
Marshall	17,174.6	12,769.2	7,039.6	3,063.8	6,107.1
Mills	8,683.3	5,178.9	4,368.9	1,901.5	3,790.1
Mitchell	15,379.1	14,517.7	4,511.2	1,963.4	3,913.6
Monona	17,787.9	7,385.1	10,002.6	4,353.4	8,677.5
Monroe	4,984.5	3,943.4	1,798.2	782.6	1,560.0
Montgomery	9,378.2	6,032.8	4,198.8	1,827.4	3,642.6
Muscatine	11,791.8	9,749.2	4,257.0	1,852.8	3,693.1
O'Brien	19,545.6	10,414.6	5,432.5	2,364.4	4,712.9
Osceola	14,290.6	8,106.3	3,860.9	1,680.4	3,349.5
Page	10,159.4	6,648.3	4,975.6	2,165.5	4,316.5
Palo Alto	19,702.7	16,676.6	7,017.0	3,054.0	6,087.4
Plymouth	24,027.9	9,858.3	7,768.7	3,381.1	6,739.6
Pocahontas	22,883.1	17,382.7	7,453.6	3,244.0	6,466.2
Polk	14,214.0	12,105.4	5,699.7	2,480.6	4,944.6
Pottawattamie	26,271.3	15,895.2	10,647.7	4,634.1	9,237.1
Poweshiek	11,421.4	8,836.2	3,016.0	1,312.6	2,616.5
Ringgold	6,649.6	5,634.5	2,650.6	1,153.6	2,299.5
Sac	23,799.5	15,641.2	8,010.3	3,486.3	6,949.2
Scott	13,817.4	10,627.5	4,989.2	2,171.4	4,328.3
Shelby	18,031.4	11,488.2	6,819.1	2,967.9	5,915.8
Sioux	19,394.7	10,732.6	7,211.1	3,138.5	6,255.8
Story	20,781.3	17,602.3	8,001.6	3,482.5	6,941.6
Tama	19,811.0	15,163.2	7,216.7	3,140.9	6,260.7
Taylor	7,307.2	5,394.6	2,947.7	1,282.9	2,557.2
Union	5,351.1	3,993.0	2,454.6	1,068.3	2,129.4
Van Buren	10,396.7	7,897.2	3,742.2	1,628.7	3,246.5
Wapello	8,348.9	6,737.7	3,319.1	1,444.6	2,879.4
Warren	8,408.3	6,326.7	4,788.4	2,084.0	4,154.1
Washington	14,074.6	10,638.9	7,338.9	3,194.1	6,366.7
Wayne	8,983.5	6,909.2	3,645.6	1,586.7	3,162.7
Webster	24,144.1	20,777.9	4,824.5	2,099.7	4,185.4
Winnebago	17,715.4	15,437.8	5,788.4	2,519.3	5,021.6
Winneshiek	14,283.8	15,043.0	5,582.9	2,429.8	4,843.3
Woodbury	26,404.5	9,839.0	9,501.5	4,135.3	8,242.8
Worth	16,265.8	16,185.0	5,373.4	2,338.6	4,661.5
Wright	25,736.3	22,064.9	10,930.2	4,757.1	9,482.3
Total	1,633,148.0	1,258,007.0	600,369.3	261,294.2	520,836.8

APPENDIX B: LIVESTOCK NUMBERS

Table B-1. Estimated number of hogs marketed in 1960, 1970, and 1975, and projections to 1985 and 1990 in thousands of head, by counties, Iowa

County	Estimated			Projections to	
	1960	1970	1975	1985	1990
Adair	180.3	236.9	157.9	219.4	238.3
Adams	121.9	158.6	102.0	136.4	147.3
Allamakee	189.9	220.4	158.0	204.2	221.2
Appanoose	65.0	74.0	37.5	53.2	56.2
Audubon	152.9	215.2	162.7	216.4	237.9
Benton	295.4	349.7	224.0	316.5	340.4
Black Hawk	209.7	179.3	140.3	148.0	156.0
Boone	139.1	149.0	107.9	131.7	141.3
Bremer	188.4	182.3	107.4	144.4	153.3
Buchanan	209.8	267.2	210.3	262.6	286.4
Buena Vista	257.6	282.1	239.2	276.9	299.8
Butler	215.3	288.4	194.2	277.5	303.2
Calhoun	128.3	166.6	113.5	159.5	173.0
Carroll	252.9	359.1	311.3	396.9	439.9
Cass	180.0	216.1	142.4	195.0	210.5
Cedar	368.0	427.8	313.5	401.3	432.8
Cerro Gordo	201.4	251.3	183.0	236.5	256.0
Cherokee	221.4	245.9	194.2	234.3	253.2
Chickasaw	176.8	196.5	131.6	165.0	177.0
Clarke	72.5	104.2	61.1	92.2	99.8
Clay	157.7	154.6	117.4	138.0	146.9
Clayton	308.9	386.7	303.5	371.5	405.3
Clinton	291.2	355.3	221.3	320.5	345.5
Crawford	259.6	374.2	269.7	377.5	416.5
Dallas	154.2	166.4	94.3	130.7	138.1
Davis	69.0	109.7	64.4	100.8	110.8
Decatur	65.3	86.6	46.4	75.7	81.7
Delaware	345.4	503.0	420.4	548.8	607.3
Des Moines	118.8	121.6	81.5	103.9	110.2
Dickinson	91.5	107.7	72.1	86.7	92.7
Dubuque	281.4	387.7	313.1	389.3	428.7
Emmet	92.9	94.9	51.2	75.0	79.3
Fayette	266.0	285.7	215.1	270.8	292.7
Floyd	141.7	157.1	107.1	137.1	147.1
Franklin	223.7	284.7	195.4	262.1	284.7
Fremont	65.7	85.3	49.4	73.9	80.3
Greene	125.6	148.3	85.4	123.8	132.1
Grundy	204.0	236.5	151.2	210.5	226.7
Guthrie	124.2	214.3	130.7	192.1	211.5
Hamilton	193.8	236.4	199.9	229.5	251.5
Hancock	186.9	256.8	204.3	258.6	284.1
Hardin	233.6	284.1	196.0	263.0	284.6
Harrison	117.1	155.4	93.9	130.2	140.3
Henry	169.1	196.6	158.5	195.6	211.9
Howard	146.0	166.7	115.1	144.7	156.4
Humboldt	132.6	127.8	89.1	102.5	108.2
Ida	172.1	210.4	143.4	197.0	212.8
Iowa	267.0	338.5	235.5	329.0	358.2
Jackson	184.4	278.1	189.5	263.4	289.2
Jasper	283.2	340.8	233.6	307.0	331.9
Jefferson	127.1	154.6	122.9	152.2	165.8

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Table B-1. continued

County	Estimated			Projections to	
	1960	1970	1975	1985	1990
Johnson	324.4	422.1	318.9	427.0	467.6
Jones	270.4	346.9	270.9	348.0	379.4
Keokuk	248.7	367.6	278.4	385.3	426.5
Kossuth	278.7	353.9	299.7	363.0	396.2
Lee	118.1	154.7	107.0	151.8	165.9
Linn	252.7	250.4	173.7	224.1	239.0
Louisa	172.2	147.0	97.1	118.4	124.2
Lucas	74.8	113.3	64.4	110.2	121.3
Lyon	187.6	249.6	193.8	256.8	282.9
Madison	142.3	173.7	108.1	160.6	173.8
Mahaska	274.3	355.9	288.0	376.4	413.9
Marion	182.2	262.3	196.3	264.4	290.8
Marshall	183.6	202.9	119.8	170.1	181.4
Mills	93.4	114.0	71.8	95.7	102.9
Mitchell	143.6	184.3	169.5	188.6	206.8
Monona	108.3	156.9	110.8	152.1	166.8
Monroe	74.3	90.7	58.4	78.9	85.0
Montgomery	149.6	188.7	100.9	157.9	169.6
Muscatine	183.6	211.1	148.1	198.7	214.3
O'Brien	211.1	247.1	172.4	232.1	251.6
Osceola	110.1	132.1	79.6	111.4	119.3
Page	175.4	218.1	142.4	201.3	218.1
Palo Alto	148.3	169.0	113.5	150.1	161.3
Plymouth	360.8	503.6	397.3	535.5	590.0
Pocahontas	169.4	199.3	115.9	170.8	183.6
Polk	88.3	88.9	45.1	69.8	73.7
Pottawattamie	252.8	314.1	175.9	250.5	268.4
Poweshiek	225.6	274.2	196.8	258.3	280.5
Ringgold	78.7	134.3	84.6	129.9	143.9
Sac	237.0	268.5	196.4	271.5	294.3
Scott	232.3	278.1	185.5	255.0	275.1
Shelby	203.2	291.0	218.3	300.4	329.8
Sioux	330.8	432.5	384.9	474.3	522.3
Story	155.3	186.3	119.0	151.8	162.5
Tama	264.2	313.4	175.7	257.6	275.5
Taylor	124.2	188.1	116.2	164.4	179.4
Union	91.7	116.8	71.7	106.7	115.5
Van Buren	76.0	112.4	87.6	112.3	123.7
Wapello	84.0	97.0	83.8	102.6	112.1
Warren	118.2	147.0	126.9	162.1	177.6
Washington	363.2	452.9	372.2	469.3	512.7
Wayne	68.7	104.2	64.2	97.1	106.1
Webster	111.2	150.6	98.3	135.7	147.4
Winnebago	139.2	154.3	90.9	130.1	138.4
Winneshiek	305.4	344.8	245.7	321.8	349.4
Woodbury	236.7	304.5	216.2	288.5	314.1
Worth	126.1	146.6	86.3	113.0	119.8
Wright	194.2	212.3	147.7	180.5	192.7
Total	18,171.2	22,505.1	16,049.9	21,261.7	23,103.6

Table B-2. Estimated number of grain-fed cattle marketed in 1960, 1970, and 1975, and projections to 1985 and 1990 in thousands of head, by counties, Iowa

County	Estimated			Projections to	
	1960	1970	1975	1985	1990
Adair	17.2	25.7	16.4	16.3	17.5
Adams	8.6	18.3	12.0	12.5	13.9
Allamakee	2.5	8.9	9.3	8.9	10.5
Appanoose	1.7	7.1	2.4	3.3	3.7
Audubon	39.7	69.0	31.2	41.5	44.6
Benton	62.1	71.4	45.9	43.1	45.5
Black Hawk	30.3	31.5	18.0	20.0	21.2
Boone	29.4	52.2	18.0	27.8	29.8
Bremer	6.6	10.7	7.3	6.9	7.6
Buchanan	23.4	27.5	16.9	15.6	16.5
Buena Vista	39.9	64.4	25.4	34.5	36.6
Butler	17.1	30.7	15.3	16.9	18.3
Calhoun	23.8	52.5	22.3	34.7	38.2
Carroll	41.9	126.6	69.3	91.5	103.2
Cass	39.2	69.9	42.9	46.7	50.9
Cedar	51.1	71.5	34.9	40.0	42.6
Cerro Gordo	19.2	22.5	17.5	12.6	13.2
Cherokee	74.7	115.6	62.0	77.5	83.6
Chickasaw	9.4	22.1	13.9	15.3	17.2
Clarke	2.3	4.6	4.2	3.9	4.3
Clay	32.6	71.2	36.3	46.2	50.5
Clayton	6.2	16.1	12.0	13.0	14.9
Clinton	86.3	130.1	70.6	77.2	82.9
Crawford	43.9	93.6	50.2	59.7	65.5
Dallas	22.0	42.9	17.5	23.7	25.8
Davis	1.6	7.5	4.1	6.3	7.4
Decatur	3.2	10.9	5.3	6.1	6.9
Delaware	15.0	23.1	17.0	15.9	17.3
Des Moines	17.8	17.6	12.0	10.6	11.1
Dickinson	14.2	35.8	23.7	26.2	29.2
Dubuque	22.2	33.2	24.3	22.6	24.5
Emmet	15.3	38.8	20.8	28.2	31.4
Fayette	8.5	36.2	21.6	28.2	33.1
Floyd	20.0	24.3	13.4	12.8	13.5
Franklin	33.7	52.2	28.3	30.9	33.0
Fremont	17.2	30.3	18.1	19.6	21.3
Greene	20.0	45.6	19.0	30.6	33.6
Grundy	33.4	54.3	26.4	32.4	34.9
Guthrie	14.0	28.4	20.8	20.4	22.5
Hamilton	36.9	37.2	22.5	21.7	22.6
Hancock	22.4	29.0	15.9	15.7	16.4
Hardin	37.0	92.4	36.6	54.7	60.4
Harrison	20.4	34.0	16.6	23.7	25.8
Henry	13.2	18.7	12.0	11.1	11.9
Howard	5.3	10.4	7.9	7.3	8.1
Humboldt	20.1	31.6	14.5	17.0	18.1
Ida	42.5	95.6	49.5	62.0	68.0
Iowa	31.9	43.7	30.3	29.2	31.4
Jackson	22.5	49.1	37.6	37.3	41.8
Jasper	29.4	59.5	32.9	38.4	42.3
Jefferson	6.9	11.7	7.2	7.5	8.2

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Table B-2. continued

County	Estimated			Projections to	
	1960	1970	1975	1985	1990
Johnson	22.9	23.0	16.2	14.9	15.8
Jones	48.8	65.1	40.6	40.5	43.3
Keokuk	11.5	18.5	13.2	12.0	13.0
Kossuth	36.8	65.6	38.5	40.9	44.2
Lee	11.2	20.0	14.1	15.5	17.1
Linn	27.5	24.9	16.9	14.9	15.5
Louisa	16.0	13.1	8.8	7.4	7.7
Lucas	2.5	11.3	6.0	7.0	8.1
Lyon	44.6	113.1	69.6	88.5	99.5
Madison	8.6	16.6	9.0	10.4	11.3
Mahaska	25.1	48.6	38.7	41.1	45.8
Marion	17.0	25.2	17.7	16.3	17.5
Marshall	46.0	60.7	22.3	31.9	33.4
Mills	26.4	48.5	27.8	35.4	38.8
Mitchell	32.4	43.3	20.2	23.0	24.2
Monona	19.3	41.0	26.4	28.7	32.0
Monroe	1.7	3.9	3.1	2.9	3.3
Montgomery	24.5	49.8	27.0	31.9	34.9
Muscatine	18.4	29.9	12.1	15.2	16.2
O'Brien	43.5	111.8	71.6	76.7	85.6
Osceola	24.5	57.5	40.4	44.8	50.3
Page	31.3	45.4	23.7	26.3	28.0
Palo Alto	21.8	49.5	24.0	32.1	35.3
Plymouth	81.3	151.7	103.2	104.6	114.4
Pocahontas	30.1	57.8	22.3	33.6	36.1
Polk	12.5	16.3	5.2	7.8	8.0
Pottawattamie	120.0	189.0	110.0	128.3	138.9
Poweshiek	23.3	30.4	20.2	19.7	20.9
Ringgold	5.5	10.9	6.2	6.4	7.1
Sac	57.5	156.1	76.1	101.4	113.2
Scott	28.2	37.9	23.4	24.6	26.4
Shelby	54.6	94.8	38.5	53.8	57.6
Sioux	83.5	249.1	193.3	218.7	250.9
Story	29.2	40.7	19.5	25.3	27.0
Tama	43.3	61.1	29.0	34.5	36.5
Taylor	9.0	16.8	9.5	10.6	11.6
Union	6.6	14.1	9.2	9.3	10.3
Van Buren	1.2	5.4	5.2	5.0	6.0
Wapello	4.4	9.7	8.4	7.6	8.5
Warren	6.5	11.1	9.4	7.8	8.4
Washington	21.9	24.9	21.4	16.5	17.6
Wayne	3.5	14.4	8.6	10.2	11.9
Webster	15.0	24.4	13.2	15.8	17.1
Winnebago	7.7	10.2	5.6	6.3	6.7
Winneshiek	5.1	16.0	14.2	14.9	17.4
Woodbury	62.3	103.1	75.2	80.1	88.1
Worth	11.7	14.9	8.7	8.0	8.4
Wright	23.2	26.4	11.6	13.2	13.7
Total	2,565.1	4,581.2	2,645.0	3,028.0	3,316.7

Table B-3. Estimated number of beef cows in 1960, 1970, and 1975, and projections to 1985 and 1990 in thousands of head, by counties, Iowa

County	Estimated			Projections to	
	1960	1970	1975	1985	1990
Adair	23.1	32.5	37.7	37.0	40.2
Adams	15.6	21.1	26.5	23.7	25.6
Allamakee	13.8	23.9	34.6	29.7	32.9
Appanoose	15.7	24.2	33.8	30.0	33.0
Audubon	8.0	13.2	19.6	17.6	19.5
Benton	16.9	19.8	26.3	23.5	25.2
Black Hawk	4.8	6.2	9.8	8.1	8.8
Boone	7.2	8.7	11.2	10.1	10.8
Bremer	1.9	3.7	6.1	5.3	6.0
Buchanan	7.1	8.7	14.0	11.7	12.8
Buena Vista	5.1	6.9	10.9	9.0	9.7
Butler	6.1	10.2	13.0	12.3	13.5
Calhoun	8.1	7.9	10.8	9.3	9.9
Carroll	12.5	16.3	19.8	17.8	19.2
Cass	16.8	21.6	30.7	25.8	28.0
Cedar	12.2	16.5	20.5	18.5	20.0
Cerro Gordo	6.8	7.3	8.2	7.4	7.8
Cherokee	6.4	13.9	21.0	20.2	23.0
Chickasaw	7.8	12.4	13.9	13.7	15.0
Clarke	15.2	20.7	24.5	24.2	26.1
Clay	6.5	8.8	13.4	11.7	12.8
Clayton	9.6	18.7	28.9	25.6	28.8
Clinton	10.4	14.4	20.6	17.1	18.6
Crawford	14.6	26.2	38.4	34.7	38.6
Dallas	9.1	12.2	15.2	14.5	15.7
Davis	11.6	22.9	34.0	32.9	37.0
Decatur	16.6	27.1	40.8	37.0	41.1
Delaware	3.9	7.2	12.3	10.1	11.3
Des Moines	7.8	9.1	13.1	11.0	11.8
Dickinson	5.0	7.4	9.9	8.7	9.5
Dubuque	9.3	14.1	22.6	18.9	20.8
Emmet	4.3	6.5	9.4	8.2	9.1
Fayette	6.7	13.9	23.5	20.6	23.3
Floyd	5.7	7.7	9.5	8.9	9.6
Franklin	6.9	8.7	11.2	9.6	10.4
Fremont	6.5	12.8	15.1	15.9	17.7
Greene	8.3	11.3	16.6	14.3	15.7
Grundy	8.8	8.4	10.1	8.6	9.0
Guthrie	17.0	27.6	31.4	31.6	34.5
Hamilton	4.9	4.1	4.9	4.4	4.6
Hancock	6.3	5.8	7.3	5.9	6.2
Hardin	7.8	11.5	13.1	11.4	12.3
Harrison	8.0	16.0	22.7	21.6	24.1
Henry	9.3	10.5	17.6	13.4	14.4
Howard	8.0	11.1	14.7	13.7	14.9
Humboldt	3.9	2.3	3.3	2.4	2.5
Ida	7.1	10.4	15.5	12.5	13.6
Iowa	20.1	28.0	33.9	33.1	35.9
Jackson	18.2	26.3	39.1	32.3	35.3
Jasper	20.4	24.8	29.1	27.0	29.1
Jefferson	9.8	13.9	15.6	14.6	15.8

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Table B-3. continued

County	Estimated 1960	1970	1975	Projections to 1985	1990
Johnson	16.1	20.7	23.9	22.7	24.4
Jones	10.5	16.5	25.3	21.6	23.9
Keokuk	14.5	19.7	27.9	24.6	26.8
Kossuth	10.1	8.2	11.1	8.7	9.0
Lee	9.0	11.1	14.9	12.7	13.6
Linn	11.7	15.7	18.0	17.0	18.3
Louisa	6.8	9.1	9.6	9.7	10.3
Lucas	13.6	26.0	28.0	31.9	35.5
Lyon	5.5	11.8	20.3	18.0	20.5
Madison	20.4	30.9	31.7	33.8	36.6
Mahaska	10.6	14.9	21.9	19.0	20.8
Marion	11.5	16.3	19.5	18.4	19.9
Marshall	13.4	16.8	20.7	18.3	19.6
Mills	5.4	8.9	10.9	10.4	11.4
Mitchell	4.4	6.0	8.1	7.4	8.1
Monona	6.0	12.6	17.5	16.0	18.0
Monroe	13.0	22.1	28.6	28.1	31.2
Montgomery	8.1	13.8	17.6	17.4	19.2
Muscatine	8.5	11.2	14.4	13.5	14.8
O'Brien	4.4	6.4	10.5	8.8	9.8
Osceola	3.4	3.5	6.5	5.0	5.4
Page	12.5	19.1	26.5	24.4	26.8
Palo Alto	4.2	4.9	7.7	6.1	6.5
Plymouth	10.9	18.9	29.5	25.5	28.3
Pocahontas	5.9	4.5	4.8	4.5	4.7
Polk	6.2	8.1	7.1	8.8	9.4
Pottawattamie	10.8	17.1	26.5	24.1	26.8
Poweshiek	19.1	24.6	31.9	28.2	30.4
Ringgold	17.2	28.7	41.7	36.6	40.4
Sac	9.8	16.1	17.1	18.0	19.7
Scott	6.1	8.2	10.5	9.4	10.1
Shelby	10.8	19.1	26.3	23.6	26.3
Sioux	2.8	5.3	11.7	9.6	10.9
Story	5.3	5.8	6.8	5.7	6.1
Tama	19.2	22.7	29.4	26.2	28.1
Taylor	19.0	29.7	33.6	33.1	36.1
Union	15.9	23.7	30.9	28.3	30.9
Van Buren	12.8	19.7	24.0	24.3	26.7
Wapello	9.2	13.3	20.0	17.7	19.5
Warren	15.5	21.7	30.1	26.9	29.3
Washington	9.8	14.1	18.3	16.2	17.6
Wayne	17.2	29.7	43.2	38.8	43.1
Webster	8.2	6.9	6.7	6.7	6.9
Winnebago	3.0	2.7	3.0	2.6	2.7
Winneshiek	12.3	21.4	28.4	26.5	29.3
Woodbury	8.4	20.9	34.9	31.4	36.0
Worth	4.1	4.4	4.5	4.2	4.4
Wright	5.5	4.7	5.9	4.8	5.0
Total	992.1	1,443.6	1,933.6	1,761.8	1,929.8

Table B-4. Estimated number of milk cows in 1960, 1970, and 1975, and projections to 1985 and 1990 in thousands by head, by counties, Iowa

County	Estimated			Projections to	
	1960	1970	1975	1985	1990
Adair	6.9	3.4	2.4	1.9	1.8
Adams	4.8	1.0	0.5	0.4	0.4
Allamakee	27.7	26.0	20.3	20.1	20.0
Appanoose	5.7	2.0	1.0	1.0	0.9
Audubon	7.3	4.5	2.5	2.6	2.5
Benton	9.4	5.6	3.6	3.7	3.5
Black Hawk	15.5	8.6	5.4	5.7	5.4
Boone	4.6	1.1	0.6	0.5	0.4
Bremer	24.7	19.4	12.0	13.2	12.8
Buchanan	17.8	10.7	8.5	7.4	7.1
Buena Vista	4.6	2.3	1.1	1.1	1.0
Butler	17.9	10.9	6.4	6.7	6.4
Calhoun	4.9	1.0	0.5	0.5	0.4
Carroll	7.8	3.3	1.9	1.8	1.6
Cass	5.1	2.4	1.6	1.5	1.4
Cedar	10.4	5.2	2.8	3.0	2.7
Cerro Gordo	7.4	2.5	1.2	1.2	1.1
Cherokee	6.0	3.1	2.2	2.1	2.0
Chickasaw	16.5	12.5	7.8	8.7	8.5
Clarke	3.3	1.3	0.6	0.5	0.4
Clay	5.3	2.7	1.1	1.4	1.3
Clayton	38.2	36.3	28.4	28.4	28.3
Clinton	11.5	7.0	5.2	4.8	4.5
Crawford	12.5	5.5	3.7	3.4	3.1
Dallas	4.7	1.2	0.7	0.6	0.5
Davis	7.7	4.0	2.9	2.4	2.3
Decatur	5.6	1.9	1.4	1.1	1.0
Delaware	31.3	29.2	22.5	22.8	22.7
Des Moines	3.5	1.3	0.8	0.5	0.5
Dickinson	4.7	2.3	1.2	1.3	1.2
Dubuque	34.5	33.8	29.5	28.2	28.3
Emmet	4.4	1.9	0.5	0.7	0.6
Fayette	34.5	26.3	19.6	19.4	18.9
Floyd	8.6	4.3	2.9	2.7	2.6
Franklin	11.5	4.0	1.9	2.0	1.8
Fremont	1.9	0.6	0.4	0.3	0.3
Greene	4.0	0.6	0.2	0.2	0.1
Grundy	9.8	5.3	2.9	3.3	3.1
Guthrie	7.0	3.0	1.3	1.4	1.3
Hamilton	4.3	0.8	0.4	0.3	0.3
Hancock	9.2	4.1	2.6	2.3	2.1
Hardin	7.4	2.6	1.4	1.2	1.1
Harrison	6.3	2.5	1.2	1.2	1.1
Henry	4.7	1.3	0.6	0.6	0.5
Howard	16.2	13.8	10.0	10.1	10.0
Humboldt	4.7	1.7	0.9	0.9	0.8
Ida	4.5	2.4	1.6	1.4	1.3
Iowa	9.1	4.0	3.0	2.6	2.5
Jackson	17.5	16.5	12.0	12.6	12.5
Jasper	11.5	5.9	4.0	3.8	3.6
Jefferson	4.3	1.3	1.0	0.7	0.7

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Table B-4. continued

County	Estimated			Projections to	
	1960	1970	1975	1985	1990
Johnson	7.0	4.0	4.0	3.0	2.9
Jones	16.7	10.8	7.4	7.1	6.9
Keokuk	7.0	2.7	1.1	1.2	1.1
Kossuth	13.6	6.4	3.5	3.5	3.2
Lee	6.7	4.2	3.3	2.8	2.7
Linn	16.0	9.6	7.5	6.4	6.1
Louisa	2.5	0.5	0.2	0.2	0.1
Lucas	4.1	1.2	0.7	0.5	0.4
Lyon	13.4	11.1	9.0	8.9	8.8
Madison	5.0	1.3	1.0	0.7	0.6
Mahaska	7.9	4.0	2.6	2.6	2.5
Marion	8.4	4.7	3.1	2.8	2.6
Marshall	7.2	2.3	0.9	1.0	0.9
Mills	2.8	0.7	0.5	0.4	0.3
Mitchell	11.2	8.8	6.4	6.6	6.5
Monona	4.6	1.5	0.8	0.8	0.8
Monroe	3.9	1.7	1.4	1.1	1.0
Montgomery	4.9	1.8	0.8	0.8	0.7
Muscatine	7.1	3.7	2.2	2.0	1.9
O'Brien	8.9	6.2	3.7	4.1	3.9
Osceola	7.1	5.6	3.1	3.7	3.6
Page	5.0	1.7	1.2	0.9	0.9
Palo Alto	5.6	2.2	1.2	1.3	1.2
Plymouth	9.6	5.7	4.4	4.1	3.9
Pocahontas	5.6	1.2	0.6	0.6	0.5
Polk	5.9	1.5	1.0	0.6	0.6
Pottawattamie	7.9	2.7	1.5	1.4	1.2
Poweshiek	8.2	3.9	2.3	2.2	2.1
Ringgold	5.5	2.6	1.2	1.3	1.2
Sac	8.1	4.2	2.6	2.4	2.2
Scott	10.6	5.3	3.4	3.2	3.0
Shelby	9.9	5.1	2.1	2.5	2.3
Sioux	20.8	16.9	14.3	13.9	13.7
Story	6.3	1.7	1.1	1.0	0.9
Tama	7.9	4.8	2.7	2.7	2.5
Taylor	6.5	1.6	1.1	0.7	0.6
Union	4.9	1.2	0.7	0.5	0.4
Van Buren	4.6	1.3	1.1	0.7	0.6
Wapello	4.3	1.4	0.6	0.6	0.5
Warren	7.4	3.6	2.4	2.0	1.9
Washington	5.5	2.0	1.4	1.1	1.0
Wayne	6.6	2.5	1.5	1.3	1.2
Webster	5.1	1.3	0.6	0.5	0.5
Winnebago	8.0	3.7	1.8	2.0	1.8
Winneshiek	36.8	34.2	26.8	26.7	26.6
Woodbury	6.8	3.0	2.1	1.9	1.7
Worth	6.8	3.1	1.6	1.7	1.6
Wright	6.4	1.7	0.8	0.7	0.6
Total	941.8	567.8	392.0	384.9	371.9

APPENDIX C: EQUATIONS

Table C-1. Hogs marketed.

Hogs marketed in each county were estimated by the following equation:

$$L_{3it} = PC_{it} \left[1 - \left(\frac{DS_t}{PCS_t} - \frac{IS_t}{PCS_t} \right) \right]$$

where:

L_{3it} denotes hogs marketed for county i in year t; PC_{it} denotes county pig crop in year t; PCS_t denotes pig crop in the state in year t; DS_t denotes pig deaths in the state, year t; and IS_t denotes shipments of pigs into the state, year t.

Table C-2. Corn sales.

The equation for estimating commercial corn sales in each county was as follows:

$$CS_{it} = CP_{i(t-1)} - \left[\sum_{k=1}^{8} (L_{kit}) (FR_{kit}) - .5 (OP_{it} - OS_{it}) \right]$$

where:

CS_{it} denotes corn sales for county i, year t; $CP_{i(t-1)}$ denotes corn production for county i, year t-1; L_{kit} denotes number of the kth class of livestock in county i, year t (index k varies from 1 to 8 and

denotes milk cows, beef cows, hogs marketed, grain-fed cattle marketed, sheep and lambs marketed, hens and pullets, turkeys raised, and broilers); FR_{kit} denotes corn feeding rates to each class of livestock in county i, year t; OP_{it} denotes oat production for county i, year t; and OS_{it} denotes oat sales for county i, year t.

Table C-3. Oat sales.

Commercial oat sales in each county were estimated by the following equation:

$$OS_{it} = OP_{i(t-1)} \left[\frac{OS_{i\ 1964}}{OP_{i\ 1964}} \quad (A) \right]$$

$$A = \frac{\frac{OS_{st}}{OP_{st}}}{\frac{OS_{s\ 1964}}{OP_{s\ 1964}}}$$

where:

OS_{it} denotes oat sales for county i, year t; $OP_{i(t-1)}$ denotes oat production for county i, year t-1; $OS_{i\ 1964}$ denotes oat sales for county i in 1964; $OP_{i\ 1964}$ denotes oat production for county i in 1964; OS_{st} denotes oat sales for the state in year t; OP_{st} denotes oat production for the state in year t; $OS_{s\ 1964}$ denotes oat sales for the state in 1964; and $OP_{s\ 1964}$ denotes oat production for the state in 1964. This

equation was based on 1964 data, because 1964 was the last year in which oat sales were published by county.

Table C-4. Soybean sales.

Soybean sales were estimated by the following equation:

$$SS_{it} = SP_{i(t-1)} \left[1 - \frac{1}{SY_{i(t-1)}} \right]$$

where:

SS_{it} denotes soybean sales for county i, year t; $SP_{i(t-1)}$ denotes soybean production for county i, year t-1; and $SY_{i(t-1)}$ denotes soybean yield for county i, year t-1.

Table C-5. Iowa's share of U.S. grain and livestock production.

Iowa's historical shares of U.S. grain and livestock production were estimated by the equation:

$$\text{A.} \qquad IaSh_{kt} = \frac{IaP_{ky}}{U.S.\ P_{kt}}$$

where:

$IaSh_{kt}$ denotes Iowa's share of class k of grain or livestock production, year t (k varies from 1 to 10 and denotes corn, soybeans, oats, hundred-weights of milk, carcass weight of beef, carcass weight of pork, carcass weight of lamb and mutton, egg production, pounds of

turkey produced and pounds of chicken produced coming from broilers); IaP_{kt} denotes Iowa's production of class k in year t; U.S. P_{kt} denotes U.S. production of class k in year t.

Iowa's share was projected to 1984-1985 and 1989-1990 by the following equation:

$$B. \qquad IaSh_{kt} = \alpha t^{\beta}$$

Table C-6. Milk production per cow and egg production per bird.

Milk production per cow was projected to 1985 and 1990 by the following equation:

$$A. \qquad MP_t = \alpha t^{\beta}$$

where:

MP_t denotes the Iowa average milk production per cow in year t. α and β are regression coefficients and t denotes time in years (t=1=1960).

Egg production per bird was projected to 1985 and 1990 by the following equation:

$$B. \qquad EP_t = \alpha t^{\beta}$$

where:

EP_t denotes the Iowa average egg production per bird in year t. α and β are regression coefficients and t denotes time in years (t=1=1960).

Table C-7. County shares of Iowa grain and livestock production.

County historical shares of Iowa grain and livestock production were estimated by the equation:

$$\text{A.} \qquad CoSh_{kit} = \frac{CoP_{kit}}{\sum_{i=1}^{99} CoP_{kit}}$$

The county shares were projected to 1984 and 1985 and 1989-1990 by the following equation:

$$\text{B.} \qquad CoSh_{kit} = \alpha t^{\beta}$$

where:

$CoSh_{kit}$ denotes the county's share of the kth class of grain or livestock for county i, year t (index k varies from 1 to 11 and denotes corn, soybeans, oats, milk cows, beef cows, hogs marketed, grain-fed cattle, sheep and lambs, hens and pullets, turkeys, and broilers); and CoP_{kit} denotes the production of the kth class of grain or livestock for county i, year t.

Table C-8. Silage acres.

The three equations used to estimate silage acres were:

$$\text{A.} \qquad SilY_{it} = \frac{CY_{it}}{6.5 \text{ bu./ton}}$$

$$\text{B.} \qquad SilR_{it} = 5\ (MC_{it}) + Y_i(GFC_{it})$$

$$\text{C.} \qquad SilA_{it} = \frac{SilR_{it}}{SilY_{it}}$$

where:

$SilY_{it}$ denotes silage yield in county i, year t; CY_{it} denotes corn yield in county i, year t; $SilR_{it}$ denotes the total tons of silage required in county i, year t; MC_{it} denotes the number of milk cows in county i, year t; Y_i denotes the 1973-1975 average silage feeding rate per head of grain-fed cattle; GFC_{it} denotes the number of grain-fed cattle in county i, year t; $SilA_{it}$ denotes silage acreage required in county i, year t.

Table C-9. Reallocation procedure.

The acreage and grain production reallocation procedure was an iterative process consisting of the systematic use of equations A, B and C for the reallocation of row crops. Equations D and E were used in an iterative process for the reallocation of oat acres and

oat production.

Equations for the acreage and grain production reallocation procedure were as follows:

A. If: $CA(1)_{it} + SilA(1)_{it} + SA(1)_{it} > TARCA_i$

then:

1. $$CA(2)_{it} = CA(1)_{it} - \left[\frac{CA(1)_{it} + SilA(1)_{it}}{TNRCA(1)_{it}} (TNRCA(1)_{it} - TARCA_i) \right]$$

2. $$SA(2)_{it} = SA(1)_{it} - \left[\frac{SA(1)_{it}}{TNRCA\ (1)_{it}} (TNRCA(1)_{it} - TARCA_i) \right]$$

3. $SilA(3)_{it} = SilA(1)_{it}$

otherwise:

4. $CA(2)_{it} = CA(1)_{it}$

5. $SA(2)_{it} = SA(1)_{it}$

6. $SilA(3)_{it}\ SilA(1)_{it}$

where:

$Ca(1)_{it}$ denotes the initial estimate of corn acres in county i, year t; $SilA(1)_{it}$ denotes the initial estimate of silage acres in county i, year t; $SA(1)_{it}$ denotes the initial estimate of soybean

acres in county i, year t; $TARCA_i$ denotes the total available row crop acres in county i; $CA(2)_{it}$ denotes the adjusted corn acreage for county i, year t; $TNRCA(1)_{it}$ denotes the initial estimate of the total needed row crop acres in county i, year t, which equals $CA(1)_{it} + SA(1)_{it} + SilA(1)_{it}$; $Sa(2)_{it}$ denotes the adjusted soybean acreage in county i, year t; and $SilA(3)_{it}$ denotes the unadjusted and final estimate of silage acres in county i, year t.

$$B.\quad CP(2)_{it} = CP(1)_{it} + \frac{CP(1)_{it}}{\sum_{i=1}^{99} CP(1)_{it}} \left[CP(1)_{it} - CA(2)_{it}\, CY_{it} \right]$$

$$C.\quad SP(2)_{it} = SP(1)_{it} + \frac{SP(1)_{it}}{\sum_{i=1}^{99} SP(1)_{it}} \left[SP(1)_{it} - SA(2)_{it}\, SY_{it} \right]$$

where:

$CP(2)_{it}$ denotes adjusted corn production in county i, year t; $CP(1)_{it}$ denotes the initial estimate of corn production in county i, year t; $CA(2)_{it}$ denotes the adjusted corn acreage for county i, year t; and CY_{it} denotes the corn yield for county i, year t.

Equation C has the same notation as B except S which denotes soybeans replaces C which denotes corn in Equation B.

$$D.\quad \text{If: } OA(1)_{it} > TCA_i - TNRCA(3)_{it}$$

Then: $OA(2)_{it} = TCA_i - TNRCA(3)_{iy}$

Otherwise: $OA(2)_{it} = OA(1)_{it}$

where:

$OA(1)_{it}$ denotes the initial estimate of oat acres in county i, year t; TCA_i denotes total crop land available in county i, $TNRCA(3)_{it}$ denotes the final estimate of the total needed row crop acres in county i, year t; and $OA(2)_{it}$ denotes the adjusted oat acreage for county i, year t.

$$E. \quad OP(2)_{it} = OP(1)_{it} + \frac{OP(1)_{it}}{\sum_{i=1}^{99} OP(1)_{it}} \sum_{i=1}^{99} \left[OP(1)_{it} - OA(2)_{it}\, OY_{it} \right]$$

where:

$OP(2)_{it}$ denotes adjusted oat production in county i, year t; $OP(1)_{it}$ denotes the initial estimate of oat production in county i, year t; $OA(2)_{it}$ denotes the adjusted oat acreage for county i, year t; and OY_{it} denotes the oat yield in county i, year t.

Table C-10. Material shares of net nitrogen nutrient requirements.

The 1972-1977 historical shares for adhydrous ammonia, urea, and nitrogen solutions of Iowa's net nitrogen nutrients sold were estimated by equation A and used to project material shares to 1984 and 1989 by equation B.

$$\text{A.} \quad MS_{it} = \frac{MN_{it}}{\sum_{i=1}^{3} MN_{it}}$$

$$\text{B.} \quad MS_{it} = \alpha t^{\beta}$$

where:

MS_{it} denotes the share of nitrogen nutrients contributed by material i in year t (i varies from 1 to 3 and denotes anhydrous ammonia, urea, and nitrogen solutions); MN_{it} denotes the nitrogen nutrients contributed by material i in year t. α and β are regression coefficients and t denotes time in years (t=1=1972).

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